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ELEVENTH SESSION

MADRID : 5-15 MAY 1930

GENERAL PROCEEDINGS

1st Section : WAY AND WORKS

INAUGURAL MEETING

6 May 1930, at 9 a. m.

PROVISIONAL PRESIDENT, THE RIGHT HON. SIR EVELYN CECIL, G. B. E.,
MEMBER OF THE PERMANENT COMMISSION OF THE ASSOCIATION.

The President. — Gentlemen, the Permanent Commission of the International Railway Congress Association desires me to preside over the inaugural meeting of the 1st Section and to propose as President Sir Charles L. MORGAN, C. B. E., director, Southern Railway (Great Britain), who will lead the discussions with talent and ability. (*Applause.*)

On behalf of the Permanent Commission I also ask you to elect as Principal Secretary Mr. R. DESPRETS, Principal Engineer at the Belgian National Railway Company. (*Applause.*)

— Sir Charles Morgan and Mr. Desprets take their places.

The President. — I feel very much indeed the honour which has been done me in asking me to preside over this meeting, and I feel my difficulties in knowing only one language. I hope that you will therefore make all allowances for this, when speakers are discussing matters, if I do not catch the purport properly.

Our next business will be the nomi-

nation of the Vice-presidents of the 1st Section. It is suggested that Messrs.:

F. Fiori, director, Italian State Railways, Member of the Permanent Commission, and

P. Lévy, chief engineer, Headquarters of the French State Railways,

be elected Vice-presidents. (*Applause.*)

— The Section, on the proposal of the President then completed the Secretariat and drew up a provisional agenda.

The President. — The first item on the agenda of this Section is « The use of concrete and reinforced concrete on railways »; but there is some little difficulty in proceeding with that question at the moment, as we are to deal with Question IX : « Relations between railways and sea-ports », in conjunction with Section III.

I therefore propose to hold immediately a joint meeting with Section III.

— The meeting ended at 9.30 a. m.

[624 .63, 625 .142.4 & 721.9]

QUESTION I

THE USE OF CONCRETE AND REINFORCED CONCRETE ON RAILWAYS.

A) *Investigation into the respective merits of the different designs of concrete sleeper.*

B) *Concrete and reinforced concrete buildings.*

Preliminary documents.

1st report (Belgium, France, Italy, Portugal, Spain and their Colonies and Switzerland), by Messrs. JULLIEN and CLAISE. (See *Bulletin*, October 1929, p. 1959 or separate issue No. 28.)

1st and 2nd supplements to this report, by Messrs. JULLIEN and CLAISE. (See *Bulletin*, October 1929, p. 2009 and June 1930, p. 1648 respectively.)

2nd report (America, the British Empire, China and Japan), by Mr. F. B. FREEMAN. (See *Bulletin*, May, 1929, p. 433 or separate issue No. 1.)

3rd report (other countries), by Mr. E. KRICK. (See *Bulletin*, December 1929, p. 2975 or separate issue No. 45.)

Special reporter : Mr. F. B. FREEMAN. (See *Bulletin*, May 1930, p. 1353.

DISCUSSION BY THE SECTION.

Meeting held on 7 May 1930 (morning).

PRESIDENT : SIR CHARLES L. MORGAN, C. B. E.

— The meeting opens at 9.30 a. m.

The President. — Mr. FREEMAN, the *Special Reporter*, is not present, and, therefore, perhaps one of Mr. Freeman's colleagues from America will read his special report.

— There being no colleague of Mr. Freeman present, Mr. DESPRETS, *Principal Secretary*, read Mr. Freeman's special report in French, English and German. This appeared in the May 1930 issue of the English edition of the *Bulletin*, page 1353.

Mr. Desprets (in French). — I wish to point out that in the 8th line of the summary relating to the first part in the French edition, the word *résilience* of the support should be replaced by *élasticité* of the support, as the latter term better conveys the meaning of the English word « resiliency ».

The President. — You have heard the special report read in the three languages, so that you are now cognisant with it, and before throwing the paper open for discussion, I would like to ask members speaking to give their names and numbers, and to speak as slowly and distinctly as possible in order to facilitate the task of reporting.

Mr. Ribera, Tangiers to Fez Railway, Morocco (in French). — As professor of reinforced concrete bridges, at the « Ecole des Ponts et Chaussées », I am in a particularly favourable position to know what progress has been made in the construction of concrete and reinforced concrete bridges in Spain.

I notice that in the reports which have been put forward only two concrete rail-carrying bridges in Spain have been referred to, and I must tell you that we have built many more than this and that Spanish Engineers have even been the first who have ventured to employ reinforced concrete in underline bridges in Spain.

For more than 20 years we have regularly built bridges for the Spanish Railways; in this connection I will refer to certain typical cases : there are for example the interurban railways of Malaga, the bridges of which were all, without exception, built in reinforced concrete more than 20 years ago. These have 12 m. (39 ft.-4 1/2 in.) spans; some have reached the exceptional span of 28.40 m. (93 ft. 2 in.).

I myself, more than 20 years ago, constructed all the railway bridges at Médina from Rioseco to Villada and from Palencia to Villalôn, also all the bridges of the narrow gauge line from Vergara and Zumarraga to Zuonaya.

As regards the broad gauge, about fifteen years ago we constructed for our railways crossing the Pyrenees from Lérida to St. Girons, two bridges in reinforced concrete, of which one reaches the then non-inconsiderable span of 20 m. (65 ft. 7 3/8 in.) with the special feature that this span is oblique to the extent of 30 degrees.

In Morocco, we have followed similar practice; all the railway bridges from Ceuta to Tetouan consist of straight spans in reinforced concrete.

All the bridges of the Spanish section of the railway from Tangiers to Fez are also in reinforced concrete, one of these bridges consisting of four spans of 18 m. (59 ft. 5/8 in.). All these bridges, it goes without saying, have been tested with the greatest success.

So far as bridges in ordinary concrete are concerned, the Spanish railway companies have followed current practice; the Southern Company, for example, is at present building 48 arches in ordinary concrete; the North of Spain Railway Company is constructing 86 arches in ordinary concrete and this Company has also considered its application for many of its bridges.

We have followed current practice to such an extent that, in the construction of all the railways we are carrying out in Spain — you know, Gentlemen, that at this moment there is a very great impetus in railway construction — the Administration of Public Works in agreement with the Council of Public Works, formed of the more senior engineers, who are the most conservative as regards such innovations, recommend definitely, that so far as possible, concrete and reinforced concrete should be used for rail-carrying bridges. Moreover, the Administration of Public Works has appointed a special commission composed of three professors of the « Ecole des Ponts et Chaussées » to study standard designs for all broad gauge

bridges of spans between 10 and 50 m. (32 ft. 9 3/4 in. and 164 ft. 1/2 in.) with arches in concrete or reinforced concrete, in order that engineers, by a rapid examination, may be able to compare the size and cost of concrete and reinforced concrete structures with that of steel bridges.

I can assure you, Gentlemen, that Spain has followed with the greatest interest the general movement for the construction of underline bridges in concrete and reinforced concrete, and that even in certain cases she has surpassed other countries which, from other points of view, have produced noteworthy works.

It is unnecessary for me to add that Spanish engineers will consider it a pleasure to give our colleagues information on any facts which might interest them.

I will allow myself to add two more words on this subject. I promised to give a paper at the Concrete and Reinforced Concrete Congress of Liége; I thought it well whilst reserving the first publication for the Liége Congress, to place this report at the disposition of the Railway Congress for its reproduction in the *Bulletin* after it has been read at Liége.

The President. — The discussion is open for the question of reinforced concrete sleepers and I request speakers to be as concise as possible in order to facilitate the work of the secretaries.

Mr. Ponticelli, Italian State Rys. (in French). — I would like to point out a slight error in the special report on the subject of the weight of the Valeri sleepers; it is stated there that the rigid girder type weighs 685 kgr. (1 510 lb.), whereas its weight with braces and attachments is 500 kgr. (1 100 lb.).

Mr. Müller, Deutsche Reichsbahn Gesellschaft (in German). — For the last 30 years, we have been making in Germany trials with reinforced concrete sleepers; these trials date back in fact to 1900. The results which we have obtained are not in favour of these sleepers. Recently, in 1928, that is two years ago, we placed in service several thousands of sleepers moulded by the centrifugal process. But up to the present these also have not given good results, although we cannot give a definite verdict on them. In particular it is the fastening of the rail to the sleeper which has caused difficulties. Quite recently, last year, we made some experiments with a reinforced concrete rail support of the Italian type; this consists of two blocks joined by a metal tie. We have placed in service several hundreds of these sleepers but we do not yet know how they will behave in service.

Mr. Jullien, *Reporter* (in French). — If I must limit myself to considering the conclusions which have been submitted to the Congress, I have only the following observation to make, that it is perhaps a little too positive to say that electrical insulation between the rails of a track carried on reinforced concrete sleepers is assured.

It is true that in substituting wood ferrules for the metal sleeves which are used for holding the coach screws, we have obtained satisfactory results and we may in this way completely solve the problem.

I will however mention some observations on the use of reinforced concrete sleepers and the difficulties which we have experienced : these difficulties con-

sist in maintaining the gauge of the track especially in curves of small radius. We started by inserting wood packings between the underside of the rail and the sleeper, but these became crushed and the gauge of the track tended to vary. We then substituted special steel shoes, arranged so that the whole under surface of the heads of the coach screws bore upon them. Finally, I must point out that our report was made two years ago, and that new trials with reinforced concrete sleepers have been made since then. I will cite particularly the Prot sleepers, which on account of their wide bases and close pitch, constitute a road having some resemblance to that on a continuous reinforced concrete platform which has been tried, I believe, in the United States. In short, with the Prot sleepers, the platform instead of being continuous as in the case of the American road to which I allude, consists of pairs of units separated by narrow gaps.

I will also mention a sleeper called the « Orion sleeper » which has been placed on trial on the French Midi Railway.

Mr. Coullié, French Midi Ry. (in French). — I should like to say a few words about a sleeper which has been tried quite recently on the Midi system, namely, the « Orion sleeper », and to give the results we have obtained after two years service.

This sleeper has been utilised in a district all lines in which have been laid on sleepers of this type; we noted, before putting the sleepers in the road all defects of manufacture. Quite recently, after two years of service, we have withdrawn several of these sleepers from the road in order to examine their condition. I must say that the results obtained appeared extremely satisfactory. We could not find any deterioration of the concrete at any part. These sleepers appear very interesting. We use them on an electrified line.

We also require good insulation and up to the present the results of the steps taken have been satisfactory.

I felt I ought to give the Congress particulars of the results which we have obtained as, although the tests are comparatively recent, they appear to me to be of such a nature as to interest the Delegates.

Mr. Desprets (in French). — What pattern are these sleepers ?

Mr. Coullié (in French). — This sleeper in made entirely in reinforced concrete. There are no metal cross ties, the connection between the two bearing units being formed by a concrete brace, which is simply slightly hollowed out below in such a manner that the middle portion of the sleeper does not bear on the ballast.

Mr. Quinquet, Paris, Lyons and Mediterranean Ry. (in French). — I would like to give some information about a lengthy trial which we made with reinforced concrete sleepers; these consisted of two pots joined by a metal tie, similar to those mentioned by Mr. Müller just now.

As we wished to have the information as quickly as possible, I arranged for these sleepers to be placed in lines carrying heavy traffic. Further, in order to test the influence of the kind of ballast on the life of concrete sleepers, I had two series of experiments carried out; on the main line from Paris to Marseilles, where we have large size ballast, and on another line, from Paris to Vichy, where we have very fine gravel ballast.

I also arranged for the sleepers to be

tried at the entrance to a station at which ordinary trains stop, and where the express trains do not stop, so as to be able to note at one and the same time the effect of braking on a sleeper and the effect of the passage of traffic at speeds reaching between 110 and 115 km. (68.3 to 71.5 miles) per hour. On the main Paris-Lyons line, I moreover suggested to the inventor of the sleeper that he had the large ballast broken up in advance as it appeared to me to be likely to damage the reinforced concrete sleepers. The inventor however did not consider this necessary. The experiments have been fairly conclusive.

On the Paris-Lyons line the sleepers had to be removed at the end of six months. As might have been anticipated the size of the ballast had had considerable influence on the damage to the sleepers. When the platelayers pack the larger stones under the sleeper, in effect they drive a hard wedge under the concrete, and it was observed that with large ballast the reinforced concrete sleepers did not stand up well. On the contrary, as regards the line of which I spoke just now, between Paris and Vichy, where the ballast is very small, the sleepers have lasted very well. They have now been in place from 6 to 7 years and no special damage has been noticed.

A question of equally great importance with which we are concerned at this moment, is that of the fastenings on the reinforced concrete sleepers. Reference has been made to driving the coach screws into blocks of wood let into the sleeper. We have made trials of this method not with concrete sleepers but with timber ones. We have tried trenails, a kind of screw of very hard hornbeam, well creosoted, which is screwed into the sleeper at the point where the coach screw is to be driven and which is bored to receive the latter. These creosoted trenails are so hard that when it is desired to trim them flush with the upper face of the sleeper with a tool specially designed for this purpose, the fragments removed by the tool break away like glass.

We have made two sets of experiments : one in the Côte d'Azur district, which is very hot and dry, and the other, the opposite, in the Jura where it is very damp. In the Côte d'Azur results were good but in the Jura, after about two years, the hard wood trenails had become so saturated with moisture that they had become quite soft, so that the coach screws came out when an attempt was made to tighten them. In fact, since the fibres of the trenails were parallel to the axes of the coach screws, the latter on sharp curves tended to move outwards and to separate the softened fibres so that as there was no longer any adhesion between the two parts, the gauge widened by as much as 18 mm. (11/16 inches). Consequently, I think that before generalising on the subject of concrete sleepers with wood fastenings of the trenail variety it would be as well to put such sleepers to the test on sharp curves in damp districts and wait 2 1/2 to 3 years before expressing an opinion.

Mr. Von Schrenk (Erie Railroad). — I was very much interested in the remarks of Mr. Quinquet, and wish to ask him whether he would be kind enough to define a little more clearly why the sleepers were not successful or why they failed, and in what manner. We in the United States of America have found that there are two causes of failure of concrete sleepers. One is the failure of the contact between the metal and the cement, and the other is the difficulty of the fastenings. The holding power of

wooden trenails is always a difficult matter in connection with the maintenance of the efficiency of the sleeper. I further wish to ask in what measure the failure of a concrete sleeper is gauged, and whether Mr. Quinquet is referring to the Vagneux sleeper we have heard so much about lately.

Mr. Quinquet (in French). — I will complete the information about the trenails.

These consist of pieces of wood whose fibres are vertical; we were in doubt whether the trenails had been forced into the wood of the sleeper or the coach screws into the trenails.

A number of sleepers after two years' use were removed to a shop and cut in sections by means of a very fine saw so as not to destroy the fastenings. We found that the trenails had not been driven into the wood of the sleepers, and also that the vertical wood fibres, normally adherent, had softened and had allowed the coach screw to penetrate the fibres which had become spongy, by separating them. The binding together of the fibres was destroyed by excessive humidity and the coach screw had penetrated in between them. The result of the experiment was thus quite conclusive.

Mr. Müller (in German). — I will complete the remarks which I made just now by adding that these sleepers have been placed in sections of railway carrying very heavy traffic, the number of trains being 200 daily.

We made the same observations as Mr. Quinquet and found that fine ballast was better for concrete sleepers than coarse gravel. The difficulty lies in the fastening of the rail to the sleeper. On this point likewise, we have made a variety of trials, but those with a timber packing have not given good results.

We have also made trials on a fairly large scale with a mixture of asbestos and concrete. These results were rather better, but one trouble which arose in this case was the rusting of the coach screws. After a certain time they cannot be screwed up without the risk of breaking them. A good attachment between the rail and sleepers is only obtained at first, later on it is impossible. We have also tried bolts passing right through the sleepers. These tests have likewise been unfortunate as cracks developed in the concrete. Moreover, in winter, water entering the cracks freezes, causing them to open further and the sleepers lose their strength at the very points where they should act as supports.

We see the difficulty which attends the use of concrete sleepers so far as the question of a good fastening between the rail and sleeper is concerned. In our opinion this problem is not yet solved.

Mr. Coullié (in French). — As regards the « Orion » sleeper in use on the Midi Railway, the coach screw is screwed into a tapered dowel of hard wood placed in position from the underside of the sleeper in a specially formed housing. This wooden dowel is fairly thick and up to the present we have not noticed that it crushes under the strains imposed by the coach screw.

Mr. Desprets (in French). — This wooden dowel has been used, I understand, on the Italian railways and has given bad results; the sleepers tend to develop cracks. I am of the opinion that these dowels can give good results only when dovetailed into their housing in the sleeper.

Mr. Coullié (in French). — I am not unaware of this difficulty and it is in this direction that we have recently ex-

perimented with sleepers in service. We lifted them out of the road in order to ascertain whether cracks had formed. After two years there were none, but I do not say that there will be none in future as the period in service is rather short.

Mr. Cambournac, French Nord Ry. (in French). — The French Nord Railway has used a large number of concrete sleepers and I would like to draw attention to a question which has not been discussed so far, namely, that of the choice of the materials of which the concrete sleepers are made.

Up to now the concrete has been tested from the view points of tension and compression which give information with regard to the way in which the concrete can resist static forces. But concrete sleepers, in common with all the materials of the permanent way, are submitted to repeated dynamic stresses.

We have observed that concretes which have given similar results in the usual laboratory tests, which are only a measure of their resistance to static forces, have behaved in a very different manner when used as sleepers in the road. I am of the opinion that it would be well worth while conducting laboratory experiments with the object of finding out how concrete resists dynamic forces, varying not only the proportions of the concrete but also its ingredients, as regards both kind and condition, such as the kind of gravel and sand and principally the degree of cleanliness of the gravel and sand.

I believe that the presence of clay, even in small quantities, in the gravel used for sleepers, diminishes to a serious degree the resistance of the sleepers to dynamic stresses in the track. This is a direction in which research work has not yet been undertaken, and I think it desirable to express the hope that systematic and scientific research will be organised thereon.

Mr. Ribera (in French). — I should like to add a few words to the observations made by Mr. Cambournac, to say that we also in Spain have made observations on the decrease in strength of concretes resulting from the presence of clay. But, on the other hand, we have also noticed that when the clay is present in the concrete in proportions not exceeding 10 %, and this clay is in a condition ef extreme fineness, the strength of the concrete in tension and compression is increased as a result of the presence of the clay, which moreover confirms the experiments of Mr. Féret, the well-known director of the Boulogne laboratory, who long ago demonstrated that the presence of powdered materials in the sand increases the strength properties of the concrete. We have also noticed that with gravel and sand having certain proportions of clay approaching 10 %, there was no loss in resistance to repeated shocks, for example, in buildings and factories subject to continuous vibrations for years. I will cite, as an example, ferro-concrete factories built in Spain 30 years ago and subjected to constant vibration caused by grinding mills used in the manufacture of cement or of flour by the Austro-Hungarian method; we have not noticed that the presence of clay in the concrete diminishes its strength when subjected to continuous shocks.

Mr. Desprets (in French). — In the resistance of concrete to shock, two factors should be considered : the resiliency of the mass and the local fragility.

In the mass, as a whole, the ferro-

concrete structure, the best braced of all, is « par excellence » the elastic structure best capable of distributing through the whole of its mass the effect of a local shock. On the contrary, under the effect of a local shock, the concrete desintegrates — it is a fragile material — only this fragility doubtless results not from an insufficient resistance to shock but rather from a deficient strength under simple tensile loading. The fragility of concrete under a heavy local shock is the defect which makes it difficult to get a good fastening or a good seating of the rail on the sleeper.

In order to obtain results of value, the shock test should be carried out on complete sleepers and not on small test pieces as in the case of similar tests on steel.

Mr. Cambournac (in French). — In order to make my ideas clearly understood I will take the following example :

On carrying out in the laboratory tests on a piece of steel under repeated shocks such as those on a Stanton Cambridge machine, it is noticed that a test piece can resist, for example, 3 000 blows of the hammer, without having revealed any sign of fatigue or shewn any crack, then, at the 3001st blow, a crack is observed which opens as the blows on the test piece are continued, then extends and finally produces complete fracture.

In concrete sleepers under traffic the same phenomenon is produced. During 2, 3 or 5 years a sleeper has done perfect service in the road and it is noticed that at the end of 2 years and 1 day, or 3 years and 1 day, or 5 years and 1 day, a crack begins to shew itself, then this crack extends, deepens and widens and with the help of moisture and age, it finally causes the total fracture of the sleeper.

There is nothing surprising about this; repetated stresses occur in the permanent way as a whole similar to those in the rails and likewise similar to those which are investigated in steel in the laboratories with the Stanton machine.

My idea is that in order to solve the problem of the strength of sleepers in the permanent way, it is necessary to make laboratory investigations into the resistance of concrete to dynamic stresses by methods similar to those which are now employed with the Stanton machine for studying the resistance of steels to repeated stresses.

What leads me to this conclusion is that I have already said, and I repeat it, concretes which have given the same strength in tension and compression, when used for the manufacture of concrete sleepers, have produced sleepers whose strengths have been extremely dissimilar in service. In the same way, steels which have shewn the same tensile strength give quite different results in their resistance to repeated stresses.

I foresee that there is a special investigation to be made into this question, an investigation, which, to my knowledge, has not yet been undertaken anywhere, and which is of extreme importance for the future of the ferro-concrete sleeper.

Mr. Desprets (in French). — As Mr. Cambournac proposes, it would obviously be interesting to study the strength of concrete as regards fragility as is done for steel. It is of no use, however, concealing the fact that the results will be of considerable uncertainty. It should be remembered, on the one hand, what divergency of results is obtained in ordinary tests on concrete in compression, and on the other hand the uncertainty of the results of the tests on the fragility of steel, a material in-

comparably more homogeneous than concrete.

It is thus highly probable that fragility tests on concrete specimens would give little useful information.

The President. — We have had a long discussion and I propose to pass to the summary.

Has Mr. Cambournac anything further to add upon the composition of the concrete ?

Mr. Cambournac (in French). — I should like to recommend the carrying out of systematic tests into dynamic effects.

Mr. Desprets (in French). — There is no objection to your suggesting a recommendation to be added to the summary of the special reporter.

Mr. Coullié (in French). — Besides the technical difficulties which ferro-concrete sleepers present, it seems to me there is also another matter, another reef on which shipwreck is risked, and to which reference has not so far been made, namely, the question of cost.

I have had the curiosity to ascertain so far as our System is concerned, what is the present cost of the maintenance of our permanent way, referred to the number of sleepers in the track, and I have tried to compare this price with the interest alone on the cost of the concrete sleepers which were offered to us. I have to say that in general the interest alone on the cost price is greater than the cost of maintenance of the tracks having timber sleepers.

It is evident that if the cost price of the concrete sleepers does not decrease and if the bank rate remains high, it would be unreasonable to use these sleepers instead of the timber ones, either oak or fir, at present in service.

Mr. Desprets (in French). — In the last part of the resolution reference can be made to the question of cost price.

Mr. Cambournac (in French). — Agreed.

Mr. Desprets (in French). — Mr. Cambournac proposes that we should make an addition to the last part of the special report, which would be worded as follows : « It is recommended that systematic tests in the laboratory and out on the line should be undertaken with a view to studying the resistance of concrete to dynamic forces, the gravel and sand to be varied as regards nature, proportions and degree of cleanliness. »

The President. — We have heard the proposed addition to the summary, and personnally I see no objection whatever to it, and think it is desirable; those in favour are asked to indicate the same by putting up their right hands.

Mr. Quinquet (in French). — I have carefully followed the remarks of Mr. Cambournac, particularly those concerning the cleanliness of sand and gravel. Mr. Riberia stated, that according to experience, 10 % of clay may be mixed with the concrete. This is rather a delicate matter; it is even dangerous because we are never sure that the admixture of clay in the gravel is everywhere the same, the mixture occurring as heterogeneous veins whose composition is very variable; the proportions of clay are sometimes 5 %, sometimes more.

I should like to refer, whilst on this subject, to some experiments we have made. Some years ago, one of our lines was carried away by a flood and it was necessary rapidly to re-establish communications over a temporary viaduct, the piers of which were built of « ci-

ment fondu » concrete. I noticed that there were delays in hardening of rather a peculiar nature in the centre portions of these thick piers. I then asked the Teil Cement Company which supplied the cement to make some comparative tests in their laboratory, which was staffed by very experienced specialists, on the hardening of this cement in thick blocks, sides 2 m. (6 ft. 6 3/4 in.) long, some of which were cast from the gravel and the slightly argillaceous sand which had been used for our concrete, others from absolutely pure gravel and sand chosen by the Teil Company itself. In order that the method of using these materials should be the same as that employed by us, I lent to Messrs. Teil the foreman who had supervised the execution of the work with us. The result has been that at the end of seven days the clayey concrete gave a strength of 50 kgr. only, whilst those composed of pure ingredients gave 97 kgr.

The question of the influence of the cleanliness of the gravel and sand has thus been very clearly demonstrated.

Mr. Desprets (in French). — If everyone agrees to accept the proposal of Mr. Cambournac, we will proceed to the second part of the question. Has anyone any observations to make ?

A Delegate. — The term « dynamic stresses » might be replaced by « repeated stresses », it is not quite the same thing.

Mr. Cambournac (in French). — I see no objection.

Mr. Müller (in German). — I am in complete agreement with the proposed addition and should like to add another word : the question of the concrete sleeper should not be considered simply as a technical question, it is of importance to regard it also from the economic point of view. Having regard to the heavy weight of this sleeper, the cost price and the cost of laying it in the track are very considerable.

— The Section adopts the summary relative to the first part of question I, having regard to the minor alterations suggested during the discussion and completed by the addition proposed by Mr. Cambournac.

Mr. Desprets (in French). — We will now pass to the second part of the question relating to structures in concrete and ferro-concrete.

— In the absence of **Mr. Freeman**, the *Special reporter*, **Mr. Desprets** reads the summary of the special report which appears on page 1361 of the May issue of the *Bulletin* (English edition).

The President. — We have just heard the special report read, and it is now open for discussion, and I request you to be as brief as possible in your remarks, because we are already behind time. I would further request that any additions which might be desired to the summary should be sent up to me in writing to facilitate the work of translation.

Mr. de Boulongne, Paris, Lyons & Mediterranean Ry. (in French). — I would propose to add a resolution to complete the summary which has just been read on the subject of new varieties of cement. This might be added « It will be interesting to follow closely the question of super-cements and other special cements, of rapid initial hardening. These cements procure savings, in permitting rapid de-shuttering, but their manufac-

ture, their storage and their methods of use are not yet well known, and the final strength of the work is subject to some lack of certainty. »

In short the manufacture of these cements is in a period of evolution and at present they are not all equally to be recommended.

Mr. Everall, North Western Railway, India. — On the North Western Railway of India reinforced concrete bridges and railway bridges with spans up to 12 feet have been in use for 10 years, and shew no signs of undue deterioration. Small cracks appear on the underside where the concrete is in tension, but they do not extend very far. The best results in service have been obtained with 12 inches of ballast under the sleepers. I draw attention to the importance of exercising great care in manufacture and its being carried out under skilled supervision, and of leaving the slabs to « cure » for a period before putting them into use.

Mr. Ribera (in French). — The reports have not considered a question which, in my opinion, is of the greatest importance, namely the deterioration which certain concrete bridges, situated close to the sea, undergo. This serious and common deterioration has been noticed in Spain in bridges constructed by the inter-urban railways of Malaga; all the bridges built close to the sea have suffered a very rapid oxidation of the bars embedded in the concrete, which ought to be attributed, in my opinion, to the insufficient richness in cement of this concrete made 20 years ago with only 300 kgr. (660 lb.) of cement, and above all to closeness of the bars to the surface of the beams.

The question of the procedure to be adopted to prevent the deterioration of concrete near the sea is at present being considered and I think that it would be useful to make mention of it in the summary as follows « and notably the precautions which should be taken to avoid oxidation of the bars in railway works near the sea ».

Mr. Desprets (in French). — I wish to add a few words to what Mr. Ribera has said. The question to be considered has two different points of view; if I have properly understood it, the deterioration of the railway structure in Malaga is due to defective construction, to an insufficient cover of the reinforcement and to a too porous cement.

This is an observation applicable to all concrete, and in particular to structures above railways lines. If it has to do with the particular attack on the concrete by chemical agents in sea water, it is a special aspect of the subject. In order to protect concrete structures under those conditions from the harmful effects of salt water, it is necessary not only to increase the density of the concrete, but equally to use special cements.

Could Mr. Ribera first describe precisely the nature of this deterioration and state exactly to what he attributes it ? Is he concerned with deterioration due to fundamental faults of construction or with an attack caused y chemical agents ?

The question ought to be looked at from these two very distinct points of view; there is no connection at all between the two sets of ideas.

Mr. Ribera (in French). — I will merely say that the question is being investigated. Specially qualified engineers have been appointed to study the methods of protecting bridges near the sea, from deterioration, but they are not yet in

agreement. « Ciment fondu » is being used, but the question has not yet been quite solved, and it is desirable that those railway companies having works close to the sea should furnish information which might be useful in determining the precautions which should be taken to prevent the destruction of certain kinds of concrete in the neighbourhood of the sea. This is of the greatest importance as regards railway bridges because, even if the destruction of concrete members in a bridge does not cause an accident, it is possible that this deterioration of the concrete, although hardly visible externally, might have serious consequences, a state of affairs which would prejudice the use of concrete in structures near the sea coast.

This question is thus much more important for railways than for marine works of any nature or water works, and those Administrations deciding to build concrete bridges near the sea are more specially concerned with this aspect of the matter than if marine works were involved.

Evidently with denser and consequently less permeable concrete, oxidation would be less.

It is not less evident that if the bars are surrounded by a layer of concrete 5 cm. (2 inches) instead of 2 cm. (3/4 inch) thick in new work, the effect of rusting will be less.

But there remains the problem of the disintegration of concrete under the effect of saline emanations from the sea, which is quite independent of accuracy of construction, the proportions used and the amount of cover.

It would be useful then if railway companies carrying out work near the sea would examine the question and inform all other companies of the results obtained or of the tests which they make.

A delegate. — From the moment that a portion of the concrete becomes inert, its porosity increases and it becomes more sensitive to the attack of marine agents; that is why the two questions are to some extent interdependent.

Mr. Desprets (in French). — Would any of our colleagues like to add any observations ?

We might then add : « and in particular the precautions to be taken to prevent the concrete being attacked and oxidation in works built near the sea ».

Mr. Ronsse, Belgian National Ry. Company (in French). — I do not consider it sufficient to investigate only the case of structures close to the sea. There are other cases much more serious. Works in reinforced concrete which are situated, for example, in contact with selenitic water, notably works constructed in ground containing gypsum are much more exposed to decomposition by contact with sulphate solutions.

Consequently, it would perhaps be well to add to the summary : « and the works exposed to selenitic water ».

Mr. Desprets (in French). — « And to other chemical agents in general », those works exposed near the sea represent only a particular instance, it is not the most serious case.

The secretary will draw up a suitable wording.

Mr. Fraser, London & North Eastern Ry. — Anything in the summary should, I think, specifically state what precautions are necessary for concrete exposed to the action of sea water, not only for the preservation of the reinforcement, but also for the concrete itself. I know of certain experiences already obtained with concrete where the proportion between

the sand, gravel and cement was not correct. Owing to this, the sea water percolated right into the concrete, and disintegrated the whole mass. In this particular case the whole work had to be reconstructed, and in doing so, very careful experiments were made to see that the proper proportions were obtained, and in addition a fine skin of a much finer concrete was placed on the larger mass. That was done a number of years ago, and it has been quite successful. In that respect, I think, it would be very desirable that some indication should be given in the summary of what should be done in cases where concrete is subjected to the severe action of the sea.

Mr. Desprets (in French). — This observation is of similar nature to those which have already been made.

Mr. Quinquet (in French). — I would like to complete the proposed addition by mentioning one of the most serious causes to be found, namely, the action of the smoke from locomotives.

We often use coal containing sulphur, and we have noticed very serious deterioration in concrete exposed to its fumes, involving considerable expense in reconstruction.

When the concrete roof of an engine shed is badly protected against infiltration, water eventually penetrates into it. Sulphurous acid being very soluble in water is formed on the wet parts of the roof and becomes converted into sulphate of lime which decomposes the cement and causes considerable damage. In order to counteract this trouble we have tried two methods; the first consists of forming linings as perfectly as possible to the soffits of the shed. Another system consists of making a protective coating to the soffits of the shed; to effect this, on the shuttering erected for the support of the concrete work is stretched at a distance of about 1 1/2 cm. (5/8 inch) a steel mesh whose points of intersection are fastened by small china lozenges; the mesh is then floated in cement and eventually forms part of the reinforced slab which likewise is protected by this interior lining of cement. It also seems desirable to utilise cements which are not affected by saline solutions for this lining; several French firms manufacture such cements.

I should like then to request that we should add not only « to selenitic water » but also « to the smoke from locomotives ».

Mr. Desprets (in French). — It is still a question of chemical action.

Mr. Quinquet (in French). — As you wish; it is important because it has to do with a frequent occurrence, with us at any rate. It is for that reason that I think it well to draw attention to the smoke from locomotives.

Mr. Carpmael, Great Western Ry. (Gt. Bn). — There are a large number of concrete structures on land and exposed to sea air, not only close to the sea, but actually in the sea. There have been several failures, and the failures were almost invariably due to bad workmanship and the presence of holes in the concrete allowing salt water or air to reach the reinforcement, causing it to expand and disintegrate the concrete. My practice now is, as far as possible, to pre-cast all concrete which is to be used in sea water, thus enabling better supervision to be given in the manufacture to ensure that all holes are filled up; and in addition the surface of all concrete structures in contact with sea water are coated with

tar. Pre-cast piles are tarred, as well as the whole structure above water. Ferro-concrete structures on land should be grouted, and this done every few years, the main object being, in my opinion, to prevent atmospheric action or chemical action on the reinforcement. If atmospheric action could be prevented, I think we could ensure solid structures.

Mr. Lemaire, Belgian National Ry. Company (in French). — I should like to request a little information from one of our Italian colleagues. Mr. Carpmael has just said that, amongst other precautions taken, he had pre-cast certain members using very dense concrete. Now I noticed in Italy, between Milan, Geneva and Ventimigla, the destruction of a certain number of fences of reinforced concrete. Some were cracked and covered with moss. I should like to know whether the cause of this is a fault in manufacture or an attack due to sea water or other chemical agents. I would be interesting to know, seeing that at the present time many companies have recourse to concrete for the manufacture of fences and that a considerable sum of money is concerned.

I should like details of this matter if possible.

Mr. Renda, Italian State Rys. (in French). — I am not in possession of this information.

A delegate. — I believe that the failure of the concrete fences in question is due to the proportion of cement used, namely, 250 kgr. (550 lb.).

Mr. Lemaire (in French). — It is an insufficient proportion.

Mr. Renda (in French). — I consider that it ought to be greater.

Mr. Lemaire (in French). — The reason is then a fault in manufacture. Might I ask our Italian colleague what proportion is used at the present day ?

Mr. Rendal (in French). — 350 kgr. (770 lb.).

Mr. Lemaire (in French). — This is also the proportion used in Belgium.

Mr. Krick, *Reporter* (in German). — I should like to make the proposal that the summary should be completed by a note urging the necessity of inspecting constructional works. If we have recently had good results there have also been bad ones attributable to faulty use of the materials, and also to failure to appreciate the chemical substances carried by subterranean waters and the chemical action of which we spoke just now. I should like to propose the words : « In order to guarantee the complete success of concrete construction, it is necessary to carry out a thorough and regular testing of all the materials employed and of the finished concrete and to exercise a stringent supervision. »

Mr. Ferreira, Portuguese Ry. Company (in French). — After having discussed the question of concrete sleepers, the Committee has touched on that of structures in general and during the course of the discussion on this subject, stress has been laid in particular on the proportions of the concrete, on the properties of this material and on the conditions of conserving it.

In my opinion insufficient attention has been bestowed on the question which was raised here by our distinguished colleague Professor Ribera, namely, that of the use of ferro-concrete for the construction of underline bridges.

I contend that this matter merits a detailed consideration by the Section, seeing that for many years the opinion has been held that ferro-concrete was made sufficiently strong to resist the very great dynamic stresses imposed by the passage of trains.

The construction of bridges in ferro-concrete and especially small bridges with beams or with slabs in ferro-concrete has now become common in many countries.

I think it would be interesting to co-ordinate the information which the various Administrations have been able to gather in order to clear up this discussion and to guide us in our future work.

I would propose that the summary of this second part be abbreviated in the following terms: « So far as railway bridges are concerned, it is desirable to collect authentic information in order to have convincing evidence of the behaviour of these structures in service, particularly under dynamic loads. »

I should also like to add as a matter of interest that, from observation, bridge members, when they crack, do so at the points of attachment, and there is a certain tendency to attribute this cracking to the hammering caused by the passage of engines, particularly the big engines used for goods trains. Likewise in the use of concrete slabs for bridges, cracks are often discovered which cannot reasonably be put down to the action of chemical agents; these are attributed rather to defects in the manufacture of the materials. One instance : after very clear and definite preliminary tests of the materials as regards their mechanical properties, etc., it has been noticed subsequently, after a long period of service, that cracks formed which could not reasonably be attributed to dynamic stresses.

This question is really most important, not only for those European countries where the metallurgical industry is well developed, but also for Portugal, where the use of ferro-concrete for railway construction is very widespread.

Mr. de Boulongne (in French). — I think it would be interesting to note the great advantage of always interposing ballast between the concrete and the permanent way either for structures entirely of ferro-concrete or for those encased in this material; for instance on the Paris, Lyons & Mediterranean Railway we often use concrete on the upper part of the bridges to deaden the shock of the trains on the metal part.

From this aspect we could make the following addition to the summary : « Underline bridges, when constructed entirely of ferro-concrete, or having slabs thereof arranged under the track on metal structures, stand up well when a layer of ballast is interposed between the concrete and the sleepers. » This is the method generally adopted on the Paris, Lyons & Mediterranean Railway.

We have strengthened a number of bridges by encasing them in reinforced concrete, and also occasionally built some entirely in this material, and we find that they give good service when a layer of ballast is provided which deadens the direct dynamic action of the trains on the work.

Mr. Desprets (in French). — Is it really of importance to introduce this supplementary resolution ? We are all in agreement over it.

Mr. Fiori, *Vice-president* (in French). — It is covered by Mr. Ferreira's general proposal. If everybody agrees, we will add to the summary of the special repor-

ter, first the addition proposed by Mr. Ribera worded as follows : « Investigations should be made into the precautions necessary for avoiding attacks on the concrete and the oxidation of the steel in constructions in the neighbourhood of the sea or which are exposed to chemical action. »

There is a second addition proposed by Mr. Ferreira as follows : « As regards rail-carrying bridges, it would be advisable to place them under systematic observation with a view to obtaining sufficiently conclusive details on the manner in which such constructions behave in use and more especially under dynamic stress. »

Finally, there remains M. de Boulongne's proposal to add the following text: « It will of interest to follow up more closely the question of super-cement and other cements of a special nature. The manufacture of these cements is in an evolutionary stage and at present they are not of equal reliability. »

Mr. Desprets (in French). — Is it wise to put in the summary « they are not of equal reliability » ?

Mr. Fiori (in French). — The second phrase might be omitted.

Mr. Desprets (in French). — There remains then the mention of super and special cements which covers all and we have decided on the three additions to make to the summary of the special reporter.

The President. — I propose that the special reporter's summary, with the three additions proposed, should be accepted.

— On a show of hands, the President's proposition is carried.

The President asks Mr. Cambournac to make known his supplement to the summary adopted.

Mr. Cambournac (in French). — During the construction of a certain number of big works in France, a large number of tensile and compression tests on concrete have been made on the site, and it has always been noticed in the course of these repeated tests, that the results improve from day to day and from week to week, and that under the influence of this constant supervision, the staff on the works gave more care to the mixing of the concrete and particularly to the quantity of water added.

Knowing that these underline bridges are subjected to special stresses, I think it would be desirable to increase the number of tests carried out on the site of the works.

I propose accordingly to move the inclusion of the following words in the summary : « It is recommended in the case of constructions of a certain magnitude that experiments in the construction-room shall be increased so as to verify the constancy of the quality of the concrete. »

The President. — I propose that the addition suggested by Mr. Cambournac be included with that proposed previously.

— This addition is adopted by the Section.

Mr. Ribera (in French). — Mr. de Boulongne has just raised a question which, I think, deserves the attention of the Congress; it is that of the use of ballast on underline concrete bridges. As a matter of information, we have constructed concrete underline bridges without ballast on the Malaga railways.

We placed the sleepers directly on the superstructure of girder bridges; even on the line from Tangiers to Fez the same method was adopted. It is now three or four years since this was done, and I was personally responsible for its introduction, because I consider that ballast, whose function is solely that of distributing the pressure from the sleepers over the deck, is superfluous since so long as the sleepers rest on a girder there is no better distributor than ferro-concrete.

In order to prevent movement of the sleepers on the floor, we have adopted several devices which are on trial and when we know definitely how these have behaved I will communicate the results to the *Bulletin* of the Railway Congress.

The first of these devices consists in casting small projecting strips in the concrete on the sleepers which prevent their lateral displacement, and the other consists of attaching rigidly the sleepers to the girders.

So far as can at present be judged these methods give good results and present an enormous advantage, especially for big beams, seeing that they distribute a superficial load on the bridges, of 2 000 to 3 000 kgr. per square metre (410 to 615 lb. per sq. foot) and thereby allow of considerable reduction in weight of the bridges.

In the deliberations of the Commission which the Spanish Public Works Administration has instituted for the study of standard bridge designs in concrete and in steel, we have touched upon this question and although I have myself presided over the Commission, as a compliment to my seniority rather than to my skill, and although I have made bridges without ballast, yet my colleagues were diffident about proposing this practice as standard for all the Spanish railways, and eventually, after study and discussion, we proposed — and the Public Works Administration adopted it — that ballast should be used under normal permanent way conditions for all arch bridges in ordinary concrete, because we consider that, for the vaults of these bridges, an increase of superficial load has no great influence on their thickness or other dimensions.

We also use ballast of full depth in the standard form of girder bridges of reinforced concrete up to 15-m. (49 ft.-2 1/2 in.) span; it is only beyond 15 m. for spans in reinforced concrete that we have diminished the thickness of ballast with the object of decreasing the dead load, and we obtain these reductions firstly by having two projections on each side of the sleeper, in order to diminish the heap of ballast and secondly by limiting the thickness of ballast under the sleepers to 10 cm. (3 15/16 inches).

This method we proposed, as adopted by the Public Works Administration, is applicable solely to spans of more than 15 m. and to bridges and arches in reinforced concrete.

For arches in ordinary concrete and for spans of less than 15 m. we suggested the sleepers being surrounded with the standard thickness of ballast as used in embankments and cuttings.

I have added these few details not with the object of asking for a further addition to the summary but to give the Section information on this particular aspect of the subject which we have discussed.

DISCUSSION AT THE GENERAL MEETING.

Meeting held on the 10 May 1930 (morning).

PRESIDENT : Mr. José GAYTAN DE AYALA.

GENERAL SECRETARIES : Messrs. P. GHILAIN and A. KRAHE.

ASSISTANT GENERAL SECRETARIES : Sir Henry FOWLER, K. B. E., Messrs. P. WOLF and J. M. GARCIA-LOMAS.

After an exchange of views between Messrs. **Ghilain**, *general secretary*, and **Sir Henry Fowler**, *assistant general secretary*, the Meeting decides to adopt henceforth the term « Conclusions » for the French edition and « Summary » for the English edition.

On the suggestion of Mr. **Leibbrand** (Deutsche Reichsbahn Gesellschaft), seconded by Mr. **Wolf**, *assistant general secretary*, the corresponding German term will be « Schlussfolgerungen ».

The Meeting after this examines the summary adopted by the first Section with regard to Question I.

This summary gives rise to no objection.

The President. — The summary is therefore as follows :

SUMMARY.

« *Part A.* — Considerable progress has « been made in concrete sleeper design. « The details of rail supports and fastenings and the suppression of centre ballast have been given particular study. « The recent installations provide resiliency at the rail support, and at the « same time seem to secure electrical insulation between the rails. The suppression of centre ballasting and elimination of centre solid portion of sleeper have reduced the weight as well as « the cost and also produced a sleeper « better able to withstand shock and vibration.

« The present status of this very important question appears very encouraging but the problem is by no means « solved. Experiments and study should « be diligently continued, taking into account the prime cost, so that we may « hope to be nearer the final solution at « our next Session.

« It is advisable to undertake systematic tests in the laboratory to investigate the resistance of concrete to dynamic repeated stresses by varying the « nature and size of the aggregate and « its cleanliness.

« *Part B.* — The subject of improvements in methods of concrete making, « better cements and aggregates and better reinforcement is of vital importance « in the general need for stronger and « more durable concrete. These should

« be given further study as well as the « methods of more accurate proportion- « ing by control of the water-cement « ratio in order to advance the general « knowledge of this very important « building material.

« It will be of interest to follow up « more closely the question of super-ce- « ment and other cements of a special « nature.

« Investigations should also be made « into the precautions necessary for « avoiding attacks on the concrete and « the oxidation of the steel in construc- « tions in the neighbourhood of the sea « or which are exposed to chemical ac- « tion.

« As regards rail-carrying bridges it « would be advisable to place these under « systematic observation with a view to « obtaining sufficiently conclusive de- « tails on the manner in which such con- « structions behave in use and more es- « pecially under dynamic stress.

« It is also recommended in the case of « constructions of a certain magnitude « that experiments in the construction- « room shall be increased so as to verify « the constancy of the quality of the « concrete. »

— This final summary is adopted by the General Meeting.

QUESTION II.

RESISTANCE OF RAILS AGAINST BREAKAGE AND TO WEAR.

A) *First causes of rail breakage; measures taken to reduce the number of breakages, both as regards the way rails are used and the conditions of inspection.*

B) *Quality of metal used for rails to give normal wear. Conditions governing manufacture and inspection.*

Rails : profile and quality, length, weight, and cross section of the rails.

C) *Rail joints. The most economical and efficient design.*

Preliminary documents.

1st report (America), by Mr. R. B. Abbott. (See *Bulletin*, May 1929, p. 483 or separate issue No. 2.)

2nd report (other countries, except the British Empire, China and Japan), by Messrs. Cambournac and Patte. (See *Bulletin*, October 1929, p. 2011 or separate issue No. 29.)

3rd report (the British Empire, China and Japan), by Dr. S. Matsunawa. (See *Bulletin*, August 1929, p. 1157 or separate issue No. 13.)

Special reporter: Mr. Cambournac. (See *Bulletin*, May 1930, p. 1362.)

DISCUSSION BY THE SECTION.

Meeting held on 7 May 1930 (morning).

Sir Charles L. MORGAN, C. B. E., in the Chair.

— The meeting opens at 9.30 a. m.

The President. — Before declaring the matter open for discussion, I feel I ought to thank Mr. Cambournac, *Special Reporter*, for the excellence of his special report, and for the very large amount of work that he has put in. I hope that the discussion that will follow will be commensurate with the labour and time that Mr. Cambournac has given to this very important subject.

— **The President** then invites Mr. Cambournac to read the summaries in his special report.

Mr. Cambournac, *Special Reporter*, read the summaries he made after reviewing the reports presented by Messrs. Abbott, Matsunawa, Patte and himself. These summaries have been given in the May 1930 number of the *Bulletin of the Railway Congress*, pp. 1370 *et seq.*

Mr. Desprets, *Principal Secretary* (in French). — We are going to read each of the proposed summaries, after which each will be open for discussion.

Mr. Cambournac (in French). — Article 1 :

It is desirable to continue the publication of data relative to rail breakages under the conditions laid down at the London Congress, the tables, however, being modified in accordance with the specimens shown in the appendix.

Mr. Van Waefelghem, Belgian National Ry. Company (in French). — I do not agree. Mr. Cambournac has just read his summaries and states that it is desirable to continue the publication of data relative to rail breakages under the conditions laid down at the London Congress, the tables, however, being modified in accordance with the specimens shown in the appendix.

I do not share Mr. Cambournac's view as to the proposed modifications in the tables. I consider that it will be almost impossible to supply the new data in a proper way.

It should be noted that these data are not provided by specialists but by men employed on the permanent way, who are asked to state definitely whether the fracture is clean and fresh, whether it started in the flange, whether or not there are surface fissures, whether the fissure is in the web, etc.

I think that the data obtained will be so vague and doubtful that it would be far better not to give them. We want clear and precise data.

Secondly, I do not consider that there is any real advantage to be gained in complicating the published data by specifying whether the damage is produced in a straight length of rail or in a curve of a radius greater than 800 metres (40 chains), or whether it is in the bottom rail or the top rail. A special official would be required to satisfy all the new requirements. However, I agree to the publication of the tables being continued in the form adopted by the London Congress.

Mr. Cambournac (in French). — I don't think anyone has raised objections to the publication of the data in the form indicated by the London Congress.

What, then, are the modifications which are proposed to-day ?

They are as follows :

1. To draw up three separate tables in place of only one for :

Rails other than underground;
Underground rails;
Total.

I don't think that the employees instructed to note the broken rails will have any difficulty in stating whether these rails were in an underground line or in the open.

2. To indicate the number of tonne-kilometres. — This is information which is furnished by the statistical departments in the same way as the number of train-kilometres. Consequently in this case also I do not see anything, *a priori*, which would be liable to complicate the work of drawing up the tables or the task of the men instructed to note the broken rails, etc.;

3. To give the percentage of broken rails on the straight and in curves, and in the latter case respecting the bottom rail or the top rail.

The French railways will have no difficulty in giving this information, because the withdrawal returns used on these railways indicate the point where the rail was removed and the row (outer or inner) to which the rail belonged.

On the other hand, the employee who makes the discovery on the spot also knows the radii of the curves in his district and he is obviously capable of distinguishing between the bottom rail and the top rail. His task will therefore be scarcely more complicated than at present.

I think that what I have just said about the French railways is applicable to the various Administrations.

4. To omit the distinction between rails with an oval stain and those without oval stain, which would result in a not inconsiderable simplification.

5. When it is a question of a fracture extending to the outer surface of the head, to indicate whether this surface has any superficial fissuring.

I admit that it will be difficult for the local employees to provide this last information without making mistakes of the same order as when they have to indicate the existence of the oval stain.

If Mr. Van Waefelghem desires it, I consent of the exclusion of this 5th modification of the London tables.

The new tables will be confined, therefore, to those which are appended to my special report, except for the omission from paragraph E, *b*) of the indications: « with superficial fissures » and « without superficial fissures » which are in brackets before the words « in the head » (*Bulletin* for May 1930, page 1378).

Mr. Van Waefelghem (in French). — I should have preferred the publication of the data to be continued in the form indicated by the London Congress, but nevertheless I agree to this proposal.

Mr. Driessen, Netherlands Railways (in French). — I should like to draw your attention to two questions. There will probably be several railways who will not be able to give the number of tonne-kilometres. The Dutch railways in particular are not in a position to provide this information, seeing that they do not keep a record of the tonnage of goods' trains.

Moreover, the number of fractures reported varies according to whether an administration pays bonuses for finding broken rails or not.

If the employees are only allowed bonuses for finding a fracture, they do not report a fissure in the rail but wait until the rail is actually broken.

The Dutch railways only give a bonus for a broken rail and I know by experience that when there is a fissured rail, the employees conceal the fact so as to be able to receive the bonus for the fracture itself.

This is a very interesting question, because there are railways who grant a bonus for fissured rails and in this case the simple fissures are reported by the employees. These fissured rails do not appear in the statistics as broken rails, which is liable to falsify the data given. In my opinion, it would be of advantage for the tables to show whether bonuses are allowed or not for finding fissured rails.

Mr. Desprets (in French). — As regards the tonne-kilometres, the same remark was made at the London Congress and it was decided to keep the table.

The President. — As it is already 1 p.m., I propose to put the question to the vote.

Mr. Lévy, *Vice-President* (in French). — We are waiting for Mr. Cambournac to reply.

Mr. Cambournac (in French). — I shall try to be very brief.

As regards the first point, the consideration which is engaging our attention is that of breakages, and when it was discussed at the London Congress it was recognised that there was advantage in referring the total number of breakages on a railway system not merely to the geographical elements of the system, to the number of kilometres of lines, but also to the whole of the elements peculiar to the traffic and the operation of the system.

At the London Congress, the number of train-kilometres was accepted as the first term of comparison, and this is, in fact, a means of appreciating the traffic on the system. It is now proposed to add the number of tonne-kilometres. I am of the opinion that it is necessary to provide this information, which would be given by all the railways who are in a position to do so. It will then be possible to compare the railways who have furnished the figures for the tonne-kilometres, and as regards those who cannot give this information, we shall be no worse off than we are at present.

It has been pointed out that fissures which are not reported in due time degenerate into breakages. This is a matter for each particular railway. If a railway believes that by a suitable system of bonuses it will be able to have the fissures reported before they degenerate into breakages, then it is the obvious duty of that railway to take those measures.

Mr. Driessen (in French). — That is just what I wish to point out. The statistics are therefore not accurate.

Mr. Cambournac (in French). — No statistics are accurate. It is not the possible fractures which should be entered into the statistics but the actual breakages, and I maintain what I have just said with regard to fractures which might have been avoided by a system of bonuses for finding fissured rails.

Mr. Driessen (in French). — Agreed. The number of breakages shown in the tables will none the less vary according as to whether bonuses are allowed for finding actually broken rails or simply fissured rails.

Mr. Cambournac (in French). — That is an understood thing. The statistics are obviously not perfect and their relative degree of accuracy is affected by numerous factors.

Mr. Driessen (in French). — Then why not say how the figure for the breakages was obtained and emphasise whether bonuses are allowed or not for fissures or for breakages.

Mr. Cambournac (in French). — I must confess that I do not understand very well.

Mr. Van Waefelghem (in French). — Mr. Driessen wants the tables to be completed by mentioning one of the following : There are bonuses allowed to employees who report rails which are only fissured. There are bonuses for reporting breakages only. If there are only bonuses for finding breakages, there is a temptation for the employees not to report the existence of a fissured rail so that they may receive later the bonus for the discovery of a broken rail. The

statistics will vary therefore from railway to railway according as to whether a system of bonuses is in force which allows a grant for finding actually broken rails or also merely split rails.

That, I think, is a clear interpretation of Mr. Driessen's idea : bonuses for a fissure or for a breakage.

Mr. Cambournac (in French). — The award of bonuses is one of the means employed by different railways to reduce the number of breakages.

Many other means are employed and if we wish the statistics to be complete and comparable as between one country and another, it will be necessary to mention not only the system of bonuses which is practised, but also all the other means which are used to diminish the number of broken rails. There is no place for this consideration in statistics. It is the actual number of breakages to which the management have to give their attention, that is to say, the number of possible accidents, whether the accidents were foreseen or not or whether the breakage of the rail was expected or not. Consequently, all the breakages in service ought to be shown in the tables.

— In view of the late hour, **the President** adjourned the discussion until the next day, 8 May.

Meeting of the 8 May (morning).

SIR CHARLES L. MORGAN, C. B. E., IN THE CHAIR.

— The meeting opens at 9.30 a. m.

The President. — We adjourned yesterday after a very long discussion on summary No. 1, and we had not finished at the time of the adjournment. I should like to ask all Gentlemen who are taking part in the discussion to be as brief as possible. Time is going very quickly, and no extension of time is possible and we wish to get the summaries discussed as briefly as can be done, commensurate with the explanation of all views. There is a proposal this morning from Mr. Matsunawa, the Japanese delegate, for an addition to the table, and I think it would be best that he should propose that addition, and it will be dealt with at the proper time as we get through the paper. Then as soon as he has finished, I will say a word about summary No. 1 with a view to seeing if we can pass it without great delay.

Mr. Matsunawa, *Reporter.* — I suggest an addition to the supplementary table which has been proposed by Mr. Cambournac. The first of these additions would consist in adding a supplementary column to the upper part of the table showing, for rails in a curve, the amount of gradient, the amount of slope.

I consider that this is one of the important conditions of breakage, according to the steepness of the gradient and I also propose that the description of the fissure, the silvery oval stain, be entered on the left side of the table.

It would be necessary therefore to make two additions :

1. Add to the first table a column showing the gradient.

2. In the part describing the breakage, mention if there is an oval stain.

The President. — The note just read by Dr. Matsunawa appears to be general, and we shall proceed to deal with the points contained in summary No. 1.

Mr. Cambournac (in French). — Mr. Matsunawa proposes that we add to the table appearing in the English edition of the *Bulletin* on page 1378 under the general heading « Number of breakages » and after the columns which are already in the tables, two other columns, one relating to rails broken on a gradient less than or equal to 10 mm. per metre, that is to say 1 in 100, the other column relating to rails broken in tracks, the gradient of which is greater than 10 mm. per metre, that is to say, more than 1 in 100. As I have just said, the table would thus be increased by two columns at the right hand side.

I myself have no objection to this. It is quite probable, as Mr. Matsunawa says he has found to be the case in Japan, that rails placed on heavy gradients are more subject to breakage than those laid on the level.

It is therefore logical to attempt to classify the breakages in terms of the gradient of the line, in the same way as I have proposed to classify them according to the radii of the curves in which these rails are laid. I have no objection, therefore, to the proposed addition.

The second proposal made by Mr. Matsunawa consists in reinstating as regards the point E, *a*) « clean and fresh fractures », the distinction adopted in the tables of the London Congress between clean and fresh fractures with or without oval stain.

I have no objection either to this addition, which only reinstates what was already contained in the previous tables, which has not caused in practice any serious inconvenience.

Mr. Van Waefelghem (in French). — Gentlemen, Messrs. Cambournac and Patte in their report said that owing to mistakes made by the local services in estimating the distinction, it would appear preferable, as regards rail breakages having a clean fracture, to omit the distinction between those having an oval stain and those without. They added that the oval stain was moreover very rare on European railways.

I also consider that it would be better to omit this distinction so as not to complicate the tables.

Some railways will never find silvery oval stains, while others will find them in quantity, and the data obtained will be meaningless.

I move that this indication be deleted from the table, in the same way as that relating to superficial fissures was deleted yesterday.

Mr. Sandberg, Ministry of Communications, Siam. — May I suggest that in the English publications we ought to keep to a known term, not « oval stain ». « Oval stain » is a literal translation of the French expression « tache ovale » which is quite suitable, but already in America, where internal fissures are so well known and are such a serious trouble, they are known as longitudinal fissures or transverse fissures. It is quite true that the transverse fissure is the dangerous one, and therefore, so far as the English language is concerned, we ought to adhere to the name that has already been known for many years. These defects should be referred to as internal fissures, and then differentiated between longitudinal or transverse.

Mr. Cambournac (in French). — We have before us two motions. Mr. Van Waefelghem proproses to delete, as regards the fracture affecting the entire rail section, the distinction between breakages with oval stain or without oval stain.

On the other hand, it seems to me that it would be difficult not to accede to Mr. Matsunawa's request. In fact, as far as I have been able to gather from reading his report, Mr. Matsunawa is interested in the question of the oval stain because he has seen numerous cases of it on the Japanese railways.

It is also the form of fracture which is engaging our American colleagues very seriously.

I ought to add that since compiling my report I have had the occasion to see in France, and on rails of relatively recent manufacture, laid under particular conditions of fatigue, fractures on a fairly wide scale, having an oval internal stain.

I think that as axle weights on the Continent increase, this form of breakage, at the present time rather exceptional, will become more common.

I therefore think that it is desirable for the future to distinguish in the table between transverse fissures with or without oval stain.

The second proposal comes from Mr. Sandberg who points out that the same defect is denoted by the expression « oval stain » and the expression » transverse fissure ». In France, « oval stain » is used, while in England and America « internal transverse fissure » is used. Mr. Sandberg even goes on to say that in studying these internal fissures, the Americans have found transverse fissures combined with longitudinal fissures, so that he proposes to specify this type of defect, that is to say, the defect which starts in the interior of the rail and gradually spreads until it causes the rail to break.

Mr. Sandberg suggests that this particular defect be given the name « internal fissure ». On this point, I am not of the opinion that such a general expression as « internal fissure » should be adopted, but I should prefer to keep the name « transverse fissure » which is that by which it is known in America. As a matter of fact, I fear that if the longitudinal fissures which occur fairly often in rails, and particularly in rails which are considerably segregated, are grouped with the transverse fissures we shall merely succeed in confusing two sets of facts and two orders of ideas which are entirely independent.

I think that in the present state of the question and until it has been studied more deeply, it is desirable to retain the feature of this particular form of fracture, which is that of being a transverse breakage.

I am therefore definitely of the opinion that the new tables should be completed by placing in brackets, opposite the heading E, *a*) « Clean and fresh fracture », the indications « with internal transverse fissure » and « without internal transverse fissure ».(*Bulletin*, May 1930, p. 1378.)

Mr. Sandberg. — I regret that my question has led to such a long discussion. I did not mean to suggest that the French name should be altered. « Tache ovale » is known on the Continent, but in England or America, or for that matter, the English language « oval stain » is not known, and was not known until these publications came out. Therefore the French name should remain, but the English should be « internal fissures », and not « oval stains ».

Mr. Cambournac (in French). — I think that for the sake of agreement it would be better to adopt in French the expression « fissure transversale », which will be more satisfactory as regards both exactness and similarity of the expressions.

The President. — We have now had a very long discussion on this question, and so far as I can gather we are in accord with the amendment proposed by Dr. Matsunawa, but not with the second portion of it. If this is so, I would now like to ask those in favour of summary No. 1 being accepted, to vote on the question; and with this understanding I believe there are some who are not in accord with the last three lines in summary No. 1, which read : « the tables, however, being modified in accordance with the specimens shewn in the appendix ». It should be understood that where the table does vary to any material extent from that settled at the London Congress, it should be optional.

Mr. Cambournac (in French). — To be exact, Mr. President, it is not the modifications of the table which are optional, but the table having been set up in this form, it is understood, as before, that the administrations will furnish the data they are able to furnish, and will not supply those which they cannot give.

I take it, for example, that an administration which cannot give the tonne-kilometres, as someone has said, will send to Brussels the table without inserting the tonne-kilometres, and I also suppose that another having breakages affecting the entire section but unable to draw a distinction between those fractures possessing internal fissures and those without will not make this distinction.

That, I think, is the opinion of the President. It is quite obvious on the face of it that with this reservation the tables may be sent in.

Mr. Driessen (in French). — Mr. President, yesterday I proposed that when administrations allow bonuses for the discovery of fissures or breakages in the rails this should be mentioned on the tables.

The discussion on this point was not finished yesterday, and I am surprised that no one has re-opened it because we are not yet quite in agreement on this point.

Mr. Quinquet, Paris, Lyons & Mediterranean Ry. (in French). — Our railway is one of those which allow bonuses for the discovery of fissures. I should like it to be made clear by a recommendation of the Congress that when a bonus is allowed for the discovery of fissures, it is a safety bonus which is given, and that a railway which does not allow bonuses for the discovery of fissures may be reproached with not having sufficient concern for safety.

Mr. Driessen (in French). — Since my proposal may not appeal to some administrations, I prefer to withdraw it.

The President. — I shall ask the meeting to vote on article 1 of the summary with the adoption of the first additions to the table.

— Carried.

Article 2 of the general summary by Mr. Cambournac :

It is highly desirable to continue the observation and study of rail breakages, and it is recommended that this

should be done in collaboration with metallurgical engineers.

The President. — I suppose there are no objections to adopting summary No. 2, which is merely common sense.

— Carried.

Article 3 :

It is desirable that the precautions indicated below should be observed in the manufacture of rails :

a) dose the steel in such a way as to avoid blow-holes;

— Adopted.

b) forbid the use of steel scrap at the bottom of the ingot moulds;

The President. — Are there any remarks to be made ?

Mr. Sandberg. — « The use of steel scrap » is not the proper way of explaining this. No steel maker would understand it. It should be : « Forbid the use of bottom plates at the bottom of ingot moulds. »

Mr. Desprets (in French). — The modification, being a question of terminology, is adopted.

The continuation of article 3 :

c) avoid splashes when pouring;

d) not to roll ingots too hot;

e) not to force the speed when blooming, so as to avoid the formation of cracks;

f) discard from the ingots the part affected by piping and segregation;

g) establish and maintain the profile of the grooves on the rolls with accuracy;

h) reduce to a minimum the cold straightening of rails, so as to diminish the stresses resulting therefrom.

Mr. Van Waefelghem (in French). — I think that we might add another requirement : whilst rolling rails during 1928 a number of tests were made by lowering the rolling temperature in the last finishing grooves down to about 900° C. (1652° F.) and we obtained remarkable results. Since this has been done, the results of our tests have been much better, and therefore I think we should do well to add :

« To terminate rolling in the last finishing grooves at a temperature as low as possible and near the critical point, say about 900° C. »

Mr. Cambournac (in French). — I quite agree with Mr. Van Waefelghem as regards the desirability of finishing rolling at a low temperature, this being, moreover, a recommendation on which metallurgists are agreed in principle.

The wording suggested by Mr. Van Waefelghem could be simplified, however, and be made briefer. It is worded: « To terminate rolling in the finishing grooves ». I think it is unnecessary to specify « in the finishing grooves » because rolling is finished in these grooves.

Similarly, it does not seem absolutely necessary to say « temperature as low as possible » and « near the critical point ». I think it is sufficient to say « at a temperature as near as possible to the critical point ».

May I add that I should not mention the temperature. I think it would be best not to make this precise statement at the present time because the point of transformation may vary according to the composition of the steel, and more particularly according to the manganese content. I think that for the present it

would be best to confine ourselves to stating the principle and to ascertain the best temperature in each particular case.

The President. — I propose that the addition suggested by Mr. Van Waefelghem according to the last wording given by Mr. Cambournac be adopted.

— Carried.

Article 4 :

It is recommended that the following should be developed :

a) macrographic tests so that the homogeneity of the cross section may be examined. In their present form, these tests can be used for elimination purposes, *i. e.* for the elimination of rails which are not uniform throughout.

— Adopted.

b) Elasticity tests for determining the degree of fragility of the metal. These tests, in their present form, do not enable fragile rails to be rejected, but they are already sufficient to serve as a basis for the granting of quality premiums. It would be an advantage if research could be continued in order to perfect a fragility test applicable to the whole cross section of the rail.

— Adopted.

c) Laboratory research and tests relative to the endurance of rails, *i. e.* to their resistance to repeated stresses.

— Adopted.

d) Research and experiments relative to the stresses which develop in rails under passing wheels.

— Adopted.

Article 5.

The following precautions are recommended in the use of rails :

a) To utilise rails obtained from the head of ingots for those parts of the line which are subjected to the least strain, and to lay them in such a manner that the wheels first run on to them at the end of the rail farthest from the ingot head.

Mr. Sandberg. — I wish to suggest that the last portion of paragraph *a*) of summary No. 5 be deleted, because it imposes a condition which it would be impossible for most railways to carry out in practice.

Mr. Mendizabal, Madrid-Saragossa-Alicante Ry. (in French). — I propose to the Section that this paragraph be deleted, because there may be difficulty in enforcing it, especially as regards the Spanish railways.

I am convinced that despite the precise instructions given by the engineers and transmitted by the foremen, the platelayers will never take such care when laying rails in the track, and I hold that in important lines there should be one class of rails only, that without any defect.

For these reasons, I repeat that I consider it dangerous for a platelayer to be able to lay in the track a rail of second quality, having some defect of manufacture, rolling, structure, etc., and therefore I propose that the paragraph should be deleted.

Mr. Van Waefelghem (in French). — The wording of this paragraph : « To utilise rails obtained from the top of ingots » may give rise to confusion or to wrong interpretation.

« Obtained from the tops of ingots » — the ingot heads have been cropped, so that this is intended to mean the rail from the top of the part remaining after cropping.

Should it be revised on these lines or

is it not perhaps preferable to specify that it refers to rails from the top of the ingot after cropping ?

I consider that it is necessary to insist on this point. When the expression « rail from the top » is used, it seems to me that it may cause confusion and if the paragraph is to be retained, I propose that this point should be stated precisely.

Mr. Carpmael, Great Western Railway, Great Britain. — I propose that this paragraph *a*) should be left out in its entirety. There should be one quality of rail and one only, and that, the quality of rail which conforms to the tests. I feel that if the proposal to put inferior rails in lines on which the traffic is lighter were carried, there would be great confusion; and if traffic conditions changed and increased on those lines, it would be practically impossible to distinguish between rails that had conformed to the tests and the rails referred to in this paragraph, and I therefore propose that the whole paragraph should be deleted.

Mr. Van Waefelghem (in French). — I understand it is said to be difficult to distinguish between rails from the top and rails from the bottom of the ingot. I fail to understand this remark. With us, every rail is marked, every rail is therefore known, and it is perfectly possible and quite easy to know which are the rails from the head and those from the bottom. In this way, it is possible to lay the rails from the heads in the lines which are less stressed, and those from the bottom in the lines highly stressed. We work in this way and we find it very much to our advantage.

Mr. Cambournac (in French). — The recommendation we are now discussing was prompted by the following two facts:

In the first place, the number of defects and breakages in rails from the top of ingots is proportionally greater than in other rails.

Despite the care taken during manufacture, the requirements of the specifications, and the vigilance of our inspectors, it is a fact, and I think will remain so, that the rails from the top will always be inferior in quality to the other rails from the ingot.

Whether one wishes it or not, therefore, the former will always be second quality rails.

Second fact : Those parts of the track which are exposed to the greatest stresses, and particularly, that part of the rails upon which the wheels first run after crossing the joint, suffer the greatest damage.

It was on account of these two facts, which once again are not very likely to be modified in the future, that it seemed appropriate to recommend — for it is merely a matter of a recommendation which each administration will apply as far as possible — to utilise rails from the top in the parts subjected to the least strain.

In order to understand what I mean by « parts subjected to the least strain » I will quote by way of example what has been done on the French Nord Railway. Leaving Paris for Creil we have a long section on a gradient of 5 mm. per metre (1 in 200). Further out of Paris, the track is on a rising gradient, and for several kilometres, the trains leaving Paris under present conditions and loads cannot exceed a speed of 80 km. (50 miles) per hour. On the contrary, the trains running into Paris, down the gradient of 5 mm. travel normally at a speed of 115 to 120 km. (71.5 to 75 miles) per hour.

We have not used the rails from the

top of the ingot in the track on which the speeds is 120 km. per hour, but we have certainly done so in the track where the speed is only 80 km. That is what I mean by a « less stressed » track. It carries the same number of axles, and the same number of trains pass over it, but under conditions of lower stress.

I repeat that this is merely a recommendation which is incapable of inconveniencing anyone. Consequently I should like to insist that the paragraph should be retained, at the same time amending the wording as follows in order to comply with the very reasonable remark made by Mr. Van Waefelghem :

« To utilise the head rails of ingots... » — the expression « head rail » being incapable of causing a discussion, while the words « rails obtained from the top of the ingot » might on the contrary lead one to suppose that the head of the ingot had been specially reserved for making rails of second quality.

Mr. Van Waefelghem (in French). — Mr. Cambournac, should it be stated that the head rail is second quality ?

Mr. Cambournac (in French). — I do not say that and I consider that it should not be stated in the text of our resolutions although it follows from the discussion we have just had.

The President. — I shall ask the meeting to vote on the question proposd in the first place, namely, whether the paragraph *a*) in question should be omitted altogether.

— The paragraph is retained.

The President. — I have not taken the opportunity of expressing my opinions on any matter that has been discussed, but I think the recommendation contained in summary No. 5 *a*) would be an impossible thing to carry out.

Mr. Cambournac (in French). — I should like to point out to the President that what he considers as impossible is being carried out, however, on the French Nord Railway. As from last year we have been laying tracks by assembling the rails and sleepers beforehand in complete lengths. We possess mechanical appliances by means of which we can withdraw the old complete lengths (rails and sleepers) from the track and lay in the same way the new complete lengths (rails and sleepers), formed, moreover, of rails 24 m. (78 ft. 9 in.) long.

Under these conditions, the working place is fed by trucks which bring up the new lengths completely assembled.

These lengths being completely assembled implies that they have passed through a workshop in which the rails and sleepers have been assembled together.

As the rails have passed through a workshop it is possible to turn them round, if need be, so that when the completely assembled length arrives on the track, they will be laid in the most favourable direction, that is to say, the end of the rail farthest away from the head of the ingot will be just at that end upon which the wheels first run on leaving the joint.

This is not theory and I say again that as from last year relaying on the French Nord Railway has been done in this way.

Mr. Müller, Deutsche Reichsbahn Gesellschaft (in German). — I support the point of view of the President. In Germany we only recognise one sort of rail. All the rails are considered as being equally good as soon as the tests on the first rail (rail A) obtained from the top of the ingot, have shown it to be sound,

that is to say, that it complies with the specification. In Germany, therefore, all rails are laid just as they come from the store. The mode of operation on the French Nord Railway is not considered applicable in Germany.

Mr. Driessen (in French). — I should like to point out — and no doubt Mr. Cambournac thinks the same also — that what Mr. Müller says is very correct, but if all the rails have been accepted, it does not mean that they are all of the same quality. This is what is suggested by Mr. Cambournac when he proposes to put the better quality rails in the most highly stressed track. As to following what has been done between Paris and Creil, why not do it everywhere if it does not cause much trouble ?

However, I have listened very attentively to what Mr. Cambournac has said and I think that it is a good method to lay the rails so that the end of the rail farthest from the head of the ingot is at the end upon which the wheels will first run in the joint. If the opportunity arises, we will do the same thing and I think that Mr. Müller will be of the same opinion.

The President. — I shall now ask the Meeting to vote on whether the second part of summary No. 5 *a*) should be omitted.

— The second part of the paragraph will be omitted.

Article 5 :

b) To load and unload rails by mechanical means.

— This paragraph is adopted.

Article 5 :

c) To inspect the rails in situ, at least once a year, on lines where traffic is intense. It is desirable to perfect appliances for detecting internal defects in rails whilst in service (Sperry detector, Suzuki detectoscope).

Mr. Matsunawa, *Reporter*. — As regards this question, that is, « resistance of rails against breakage and to wear » the quality of steel used, and other factors are taken into account, but I think it is highly important to study the three points indicated below :

1. Observation and study of stresses in rails in service, namely endurance tests of rails.

2. Apparatus for measuring stresses.

3. Research relative to wear.

The Japanese Government Railways have been studying the above three points for 5 years and their investigation is nearing completion.

As to the 1st point, a paper was published by Mr. S. Ikeda, mechanical engineer of the Japanese Government Railways, as shown in appendix III of my report *(Bulletin of the Railway Congress*, August 1929, page 1252).

As to the 2nd point, a 3-element oscillograph apparatus was used several times in the experiments and furthermore one of 6 elements was completed and had been successfully tested last April, at the time I left Japan. I regret, however, that the report was not ready in time, as it was my intention to have it published in the *Bulletin of the Railway Congress*. The principle of the apparatus is as shown on page 1182 of my report. I have brought with me from Japan a photograph of the 6-element oscillograph apparatus.

As to the third point, I may say that the wear of rails has already been studied

over a period of more than five years by the research department of the Japanese Government Railways, at an expense of over 100 000 pesetas and that these studies are still being continued. Copies of two papers of over 150 pages concerning the study of wear on rails, in the names of Dr. Saito and Dr. Suzuki respectively were presented to the Association last October as an appendix to my report, but it was impossible to include this relevant matter in my report.

However, the essential points of the two papers are set out on pages 1206 to 1210 of my report.

According to Dr. Suzuki's research, the question of wear of rails cannot be treated without taking into consideration the quality of the tyres coming in contact with the rails.

According to the research made by Dr. Saito, engineer of the Sumitomo Works, it is desirable, in order to reduce the wear, that the tyres used should be made harder and the carbon content of rails should be above 0.7 % or below 0.35 %. Anyhow, making the tyre as hard as possible is one of the most important factors in reducing the wear of rails.

Dr. Saito is here present, and he will be pleased to answer any questions in connection with his investigation.

I may say that I have here a copy of his paper and photographs of the experiment, which I will show you if you are interested in them.

Mr. Cambournac (in French). — I have alluded to the Sperry detector with which we are acquainted through the articles published in the American periodicals.

This apparatus has already undergone a number of somewhat profound alterations which have been reported, and it would be of great interest if a colleague on the American railways would kindly give us some information on the services which this detector is giving at the present time.

Mr. Müller (in German). — About two years ago we got into touch with the Sperry Company with a view to ordering a truck, but so far the negotiations have not materialised. The Sperry detector is not suitable for examining tracks having metal sleepers, and it can only be used on tracks laid on timber sleepers. At the present time, the Reichsbahn is collaborating with the Siemens Company in designing a new apparatus. We shall first of all attempt to locate the presence of internal fissures in rails before they are laid in the track and we shall only lay rails which have been tested by means of this apparatus. Later on perhaps it will be possible for us to improve the truck and then examine rails laid in the tracks. At all events, the Sperry Company have informed us that they are unable to provide an apparatus which would be suitable for the Reichsbahn.

Mr. Desprets (in French). — Has anyone any remarks to make on this subject ?

— Paragraph *c* is adopted.

Article 5 :

d) To use rails which have received suitable heat treatment on sections of line where the rails are subjected to exceptional stresses, to skidding and to repeated braking, rails so treated resisting the propagation of superficial fissures (cracks in the running surface) better than rails which have not been treated.

Mr. Cambournac (in French). — I should like to give a few details regarding the tests which have been made in

France on the subject of this question of brittleness.

Rails in service acquire a particular brittleness due to the transformation and damage to which their running surface is subjected. This damage appears in the form of fine cracks in the upper surface of the bullhead, especially in the portions of the track which are subjected to frequent braking and skidding of locomotives or due to the length of time the rails have been in service, and as a consequence of the prolonged cold-working of the metal.

The tests made in France consisted in causing a locomotive coupled to a train to run on rails of different qualities heat-treated or non-heat-treated. Just as it runs on to the experimental track, the locomotive is made to slip by suddenly opening the regulator wide. The locomotive wheels then revolve at very high speed, and by keeping the regulator open it is possible to cause the slipping locomotive followed by its entire train to pass over all the rails under test. These rails are subjected to extremely violent slipping stresses, which are repeated, moreover, as desired. In the series of experiments which were carried out the number of times the rails were run over exceeded 100.

After this test, the rails are withdrawn from the track. Their surface then exhibits defects, cracks and fissures similar to those observed in rails in service. The rails are subjected to impact tests, during which they are placed with the flange uppermost and the head down.

These tests have shown that two rails obtained from the same ingot, one in the natural state, while the other has undergone suitable heat treatment, stand the blows in quite a different manner.

Under the shock of a tup falling from a very low height (0.50 m. = 1 ft. 11 7/16 in.), the non-treated rail breaks like glass, while on the contrary, the heat-treated rail stands without breaking several blows of the tup falling from much greater heights, even up to 3 or 4 m. (13 ft. 1 1/2 in. to 16 ft. 5 in.).

In view of these facts, it seemed to me desirable to recommend the heat treatment of rails, particularly when intended for parts of the track subjected to repeated braking and slipping.

Mr. von Willich, South African Railways & Harbours. — Our experience in South Africa is contrary to the results which have been obtained by Mr. Cambournac as regards heat-treated and non heat-treated rails of the same composition. The heat-treated rails had a greater rate of failure than the non heat-treated rails. I wish to make it clear that I am speaking of rails which had a high carbon content, and were treated by another process to those now generally used, *i. e.* the water spray was applied to the head of the rail after its final pass through the rolls. The increase in the proportion of fractures was not such as to cause any concern but definitely occurred in rails from a number of manufacturers who supplied heat-treated and ordinary rails, of the same quality otherwise.

Mr. Cambournac (in French). — I spoke just now of tests, but I should not like it to be thought that the French railways confine themselves to tests which are rather of the nature of laboratory tests.

At the present moment on the French railways 7 or 8 thousand tons of heat-treated rails have been laid, and these rails, which have been in service 7 or 8 years, without any breakage occurring so far, have been found to be superior

to non-treated rails from the point of view of brittleness. In addition, they have given more satisfactory results than the ordinary rails from the point of view of wear, a point to which we shall return later.

Mr. von Willich. — I further wish to point out that the experiments on the South African Railways were made on not less than 400 miles of track laid with heat-treated rails supplied by a single manufacturer, without considering those supplied by other makers. The experiments lasted a long time : about 15 years. By this I do not wish to convey that I am opposed to the heat treatment of rails, and I wish to repeat that our experiments were carried out mostly on rails with a high carbon content, heat-treated by water spray on the head of the rail.

The President. — Has anyone any objections to raise ?

— Paragraph *d*) is adopted.

Mr. Desprets (in French). — We shall now pass on to article 6 :

The length of rails can, without inconvenience, be increased to 24 m. (78 ft. 9 in.), and research and tests should be continued with a view to increasing the length beyond 24 m. (if necessary by means of aluminothermic welding), particularly at special points of the line where the effects of expansion are less to be feared.

Mr. Müller (in German). — The Reichsbahn has decided to increase on the more important lines the normal length of the rails to 30 m. (90 ft. 5 1/8 in.) and no inconvenience resulted during the severe winter of 1928-1929, nor during the exceptionally hot summer of 1929. Up to the present, we have equipped 3 500 km. (2 175 miles) of our most important tracks with rails at least 30 m. long. In addition, we have carried out large scale tests with rails 60 m. (196 ft. 10 1/4 in.) long, by welding two rails by the aluminothermic process. We have also welded several rails over a length of 120 m. (393 ft. 8 1/2 in.) and even in these cases no difficulty has arisen. On the bridges, which are provided with special expansion devices, and in tunnels, we weld rails up to 500 and 600 m. (1 640 to 1 970 feet) in length. We have been able to go up to these lengths because our new type of permanent way provides, between the rail and the sleeper, an exceptionally strong connection, much better than any previous one.

Mr. Sandberg. — I imagine that the very interesting results that Mr. Müller has given us refer to freedom from difficulties in connection with expansion. I think, however, that the Meeting will be very interested to learn whether any tests have been made on the welds, because we all know that welding is permissible and that the art has progressed enormously during the last few years.

Mr. Mendizabal (in French). — I should like to be allowed to make a remark on the subject of the first part of summary 6. In Spain we have had experience of the transport of rails 24 m. (78 ft. 9 in.) long and we have encountered considerable difficulty owing to the special conditions of the lines on the Spanish railways.

Our lines comprise very uneven, and almost mountainous profiles. We regard the length of 15 m. (49 ft. 2 1/2 in.) as a maximum.

As regards laying the rails, we also experience great difficulties with the rail

joints. These difficulties are due to the wide variations between the day and night temperatures.

If we use very long rails, the gap at the joints will be very wide, with the resultant drawbacks on curves as regards the rolling stock and the passengers' comfort.

We have made experiments in tunnels up to a length of 200 m. (656 feet) without inconvenience and in steel bridges we have welded the rails up to a length of 100 m. (328 feet) also without inconvenience, employing of course special means for taking up the expansion according to the climatic conditions. For these conditions I think that we might add to the passage « can, without inconvenience, be increased to 24 m. (78 ft. 9 in.) » the words « in general », with the object of excepting certain local conditions.

Mr. Tettelin, French Nord Railway (in French). — The question we are discussing at the moment is all the more interesting because it enables us to consider a real progress in the construction of the track.

The rail joint constitutes an evil. At each joint the vehicles experience a shock, as do the sleepers, both of which are detrimental to smooth running. The more joints we eliminate, the closer will the smoothness of the track approach the ideal to which we are tending.

Consequently, Mr. Müller's contribution deserves to be borne attentively in mind. I should, however, like to make one remark : we have all had acquaintance with serious accidents due to the expansion of the rails in very hot summer weather. The rail then takes on a zig-zag shape, a train is derailed and a catastrophe is possible.

With very long rails that are subjected to considerable temperatures, the expansion which cannot have free play produces stresses stored up within the rails like springs, and if such a long rail is given a transverse shock, will not these stresses be liberated, giving a curved shape to the rails, so that if this takes place under the passage of trains, we should have instead of regular track the irregular track which gives rise to derailments ?

This is the thought which should predominate in the question. If we can manage to eliminate the risk of the transverse deformation of the track under the trains despite the stresses which are stored up in rails of considerable length and which cannot be propagated and released at the ends, the question will then have been solved completely.

Until this point has been cleared up it will remain doubtful.

Mr. Zavadil, Ministry of Railways, Czechoslovakia (in French). — M. Mendizabal has said that the transport of rails longer than 15 m. (49 ft. 2 1/2 in.) presented several difficulties. According to our experience in Czechoslovakia there are no such inconveniences and we have standardised the length of rails weighing 44 kgr. (88.7 lb. per yard) at 20 m. (65 ft. 7 3/8 in.) and that of rails weighing 49 kgr. (98.8 lb. per yard) at 25 m. (82 ft. 1/4 in.). These are the standard lengths which are supplied by the works and laid on our principal lines.

The possibility of increasing the length of the rail depends, however, upon several factors, chief of which are : the rail cross section, possibility of handling the rails, the construction of the rail joints and of the track, local variations of temperature and others.

I consider that the length of the rail may only be increased if the accessory

pressures or tensions of the rails in service, caused by the temperature variations, can be neglected with regard to the state of the track.

I think that this opinion is also shared by Messrs. Cambournac and Patte who express themselves as follows : « it appears that there is no inconvenience in increasing the length of the rails if the superstructure is sufficiently heavy and robust », and it seems to me that this is also the opinion of Mr. Müller as regards the German Railways.

That is why it appears to me to be necessary that this important condition should be embodied in the article which I propose to amend in principle as follows :

« The length of rails of a weight greater than 42.5 kgr. per m. (85 lb. per yard), assuming suitable fixings, may, without inconvenience, be increased to 25 m. (82 ft. 1/4 in.), perhaps 24 m. (78 ft. 9 in.) », which practically amounts to the same thing.

« Research and tests on light rails, *i. e.*, of a weight less than 42.5 kgr. per m. (85 lb. per yard) should be continued, however, with a view to increasing the length beyond 25 m. — if necessary by means of aluminothermic welding, or by other suitable processes, particularly, etc. », as stated in this article.

Mr. Fowle, Great Indian Peninsula Railway. — Mr. Müller has stated the German Railways have experienced no difficulty regarding expansion and contraction of these long rail lengths. In India, where there is a difference of 25° to 30° F. between mid-day and midnight, we find the greatest difficulty in dealing with the expansion and contraction in rails. I wish to ask what gap was allowed at the joint by Mr. Müller for these long rail lengths, and what was the greatest difference in temperature between mid-day and midnight, midsummer and mid-winter.

Mr. Simonsson, Bergslagen Ry, Sweden. — In Sweden we have for the last two years tried rails 45 and 60 m. (147 ft. 8 in. and 196 ft. 10 in.) in length. Very good results, were obtained provided that the ballast was very good and the fastening of the rail to the sleeper was able to prevent rail-creeping. In order to prevent mistakes and bad results, I wish to add a few words about this question.

For our first tests we have used electric welding, Kjellberg system. The results have been good, but not good enough. We have now decided to weld every other joint, and have made choice of electric resistance welding, called in Germany *Schmeltzschweissung*, and which, according to the tests we carried out, promises to give very good results. The cost is very moderate, lower than by other methods.

Seeing that good results can be obtained by other methods than thermit welding, I propose that the word « aluminothermic » in article 6 be deleted.

Mr. Müller (in German). — I should like to explain that we have been led quite naturally to the use of long rails as the result of long years of experiments and laboratory tests. In these tests, the stresses produced in service by the variations in temperature were produced by means of hydraulic presses. The gaps at the joints were calculated exactly and the possibility of transport, even in sharp curves (R = 180 m. = 9 chains) was shown by taking films. We came to the conclusion that the use of these long rails presents no inconveniences. It is merely necessary that they should be laid at a normal temperature of 10 to 20° C. (50

to 68° F.) so that the difference will not become too great.

Mr. Cambournac (in French). — The exchange of views which has just taken place on article 6 leads to three concrete proposals to modify its original text.

The first modification which was proposed by Mr. Mendizabal consists in introducing the words « in general » into the text. It would read « the length of rails can, in general, and except for special circumstances, be increased without inconvenience to 24 m. (78 ft. 9 in.) ». Mr. Mendizabal bases his request on the difficulties of transporting rails of a length greater than 15 m. (49 ft. 2 1/2 in.).

He has already been answered and I should like to affirm that the transport of rails of any length does not offer any problem. I might even say that the transport is easier, the longer the rails.

In fact, it follows from the tests which the International Railway Union has made that, in order to transport rails of considerable length, it is merely necessary to place them on several successive trucks without making any preparation or taking any precaution. Experience has shown that nothing abnormal takes place when a train made up of these loads is run over a mountain line or very complicated points and crossings, or even when the trains are set back.

There are no difficulties, therefore, as regards the transport of very long rails, and in these circumstances I think that Mr. Mendizabal will not insist upon this point.

The second proposal comes from Mr. Zavadil who points out that this conclusion would not perhaps be exact for rails of lesser weight or for rails of a weight greater than 40 to 45 kgr. (80 to 90 lb. per yard).

Mr. Zavadil does not raise any objection to this statement, therefore, when it applies to rails of a weight of 42 to 48 kgr. (84 to 96 lb. per yard), but he makes reservations if the rail is lighter or heavier.

In proceeding to examine this question, I wonder what are the influences which may intervene to deform the track when it is composed of very long rails. As we have already said, these influences are the internal stresses developed in the rails by the effect of the temperature, an effect which must be resisted by the track owing to the friction of the sleepers on the ballast.

I think that, *a priori*, the heavier the rail, or the greater its cross-sectional area, the more considerable becomes the total stress developed by the temperature in the rail. Therefore, if the track comprised the same number of sleepers per metre, I think that the risk of the track being deformed would be greater, the heavier the rail, all other things being equal. This leads me to conclude, that, seeing that it has been found that the length of 24 m. (78 ft. 9 in.) with rails of 42 to 48 kgr. (84 to 96 lb. per yard) is without inconvenience, there should not be any inconvenience in reaching the same length : 24 m., with rails of smaller section and lesser weight. If I had any reservation to make, I should make it on the contrary, for rails of heavier section.

I consider therefore that the wording can be left as it stands, with the following slight modification : « the length of rails of small and medium weight may, without inconvenience, be increased to 24 m. (78 ft. 9 in.) », leaving aside the question of heavy rails, which would probably raise difficulties.

The third remark was made by Mr. Simonsson who is surprised that, in speak-

ing of welds, I have only mentioned aluminothermic welding. To my knowledge, it is the only welding process which has given really satisfactory results. I earnestly wish that as good results could be obtained with electrical welding, but the enquiry I made in compiling this report showed that the electrical welding processes utilised up to the present have resulted in disappointment, whereas the number of breakages produced with aluminothermic welding is extremely small. For this reason I put « aluminothermic welding » and not « welding », while expressing once more the wish that processes of electrical welding will be perfected to give the same satisfaction.

Mr. Desprets (in French). — I should like to add one remark to what Mr. Cambournac has just said.

The resistance of the track to lateral displacement may be compared with that of a member loaded on end and tending to buckle in a resistant medium. Its buckling load is the sum of two expressions, one representing this load in a free medium, and the other proportional to the lateral resistance of the medium. The latter is therefore proportional to the friction between the sleepers and the ballast and to the bearing of the sleepers on the ballast. It is independent of the cross section of the rail.

The first expression which is the resistance to buckling of the free track may be considered as being proportional to the transverse moment of inertia of the track. Neglecting the transverse moment of inertia of the rail itself, the moment of inertia of the track is equal to half the product of the cross section of a rail multiplied by the square of the gauge of the track. This expression is therefore proportional to the cross section of the rail. If the total stress due to the expansion, on one rail, increases in proportion to the cross section of the rail, the resistance of the free track to buckling increases in the same proportion.

It is not certain, therefore, that the heavy rail would be more unfavourable than the light rail from the point of view of lateral displacement. The question should be examined more thoroughly, if necessary experimentally, by evaluating the lateral resistance of the track to slipping.

Mr. Cambournac (in French). — Since the text may give rise to confusion, I have no objection to its being modified in order to make it more precise. I have had no experience of what takes place on tracks equiped with light rails nor with heavy rails, and since it is a question of a statement, I would willingly say « the length of medium rails ». We will say, then : « The length of *medium* rails can, without inconvenience, be increased... »

Mr. Coullié, French Midi Railway (in French). — It seems to me that it is difficult to separate the question of the length of the rail from the conditions under which the track has been laid and that would appear to explain the contradistinction to be found between certain observations.

On the one hand we have the German railways allowing rails of 60, 80 and 120 m. (196 ft. 10 1/4 in., 262 ft. 5 3/4 in. and 393 ft. 8 1/2 in.) without any inconvenience resulting, while on the other we know very well that on some tracks, where the rails are not even welded, it is merely necessary for two or three rails to come into contact to find, in periods of high temperature, the track assuming the sinuous shapes which cause accidents.

This is what Mr. Tettelin was alluding to a short time back. I consider that the two questions are bound intimately together, and that it is impossible to deal with one without the other, which is, I think, the opinion of Mr. Zavadil also.

However I am satisfied with the summary. At the same time the last words should perhaps be modified. Contrary to what Mr. Cambournac proposes, I would not introduce the word « medium » for the rails, but instead say : « particularly at special points of the line where the effects of expansion are less to be feared », I would put this phrase : « if the conditions in which the track is laid make the effects of expansion less feared or if it is a question of special places offering similar guarantees ».

Mr. Cambournac (in French). — Mr. Coullié's request is met since it is stated that « Research work and tests should be continued ». This research work and tests would more particularly deal with the construction of the track. It is evident that the questions cannot be separated. It would not occur to anyone to make tests on tracks with rails three metres long laying them with a spike on matches. The problem does not merely consist in the increase in the length of the rails but in laying the rails on the sleepers and in the tracks, therefore, it is useless to add anything else.

Mr. Coullié (in French). — You would appear desirous of limiting the tests to the special points. I would define the problem without limiting then.

Mr. Cambournac (in French). — It says « research and tests should be continued with a view to increasing the length beyond 24 m., particularly at special points » and that does not mean that it is only there that it should be done. The text is complete.

Mr. Coullié (in French). — But it seems to limit the question to the less interesting points.

Mr. Desprets (in French). — The wording simply draws attention to them, but it is not exclusive.

Mr. Coullié (in French). — The question is chiefly of interest as regards the track in its entirety. It is not merely the special points which are engaging the attention of the railways at the present moment, but it is above all the problems in their entirety, and I think it desirable not to limit them. Having said that, I shall not insist.

Mr. Müller (in German). — I propose that Mr. Cambournac's wording : « Medium rails » be accepted.

The President. — I shall now ask the Meeting to vote on the wording proposed by Mr. Cambournac, without variation, that is to say, as it appears in the special report.

— Carried.

Mr. Desprets. — We now come to article 7 of the summaries of the special report :

With a view to reducing normal wear in rails, it appears desirable to give the running surface, when new, the average cross section which it tends to assume in service.

Mr. Matsunawa. — It is necessary and important to take into consideration the tyres.

I therefore propose to supplement article 7 by the following two points :

« 1. — To reduce the normal wear in

rails it is necessary to take into consideration that the wear varies considerably according to the quality of the tyres, and consequently it is advisable to standardise the proportion of carbon.

« 2. — The lateral wear of rails and tyre in curves is considerably reduced by increasing the carbon content of the steel, and for this reason it is advisable to increase this carbon content as much as possible. »

Mr. Müller (in German). — I propose that Mr. Cambournac's wording should be accepted without modification, putting : « the necessary relations between the tyre and the rail ».

Mr. von Willich. — I propose that this article No. 7 be deleted. My experience is that it does not seem possible to roll a rail otherwise than symmetrical.

Mr. Cambournac (in French). — I can at once reassure our colleague. By saying: « the average cross section which the running surface tends to assume in service », I meant that part of the cross section which is the active part, that is to say, which comes into contact with the inner radius of the tyres. I did not mean the outer part of the rail. My proposal would not therefore imply rolling a rail which is not symmetrical, but rolling a symmetrical rail, the cross section of which is formed on both sides by the shape assumed in service by the active side of the head of the rail, *i. e.*, the side in contact with the wheel tyre.

The President. — I shall ask the Meeting to vote on the retention of article 7.

Article 7 is retained.

Article 8 :

With a view to reducing lateral wear on curves, an endeavour should be made to perfect and develop appliances for lubricating the lateral faces of the head of the rail and of the wheel tyre, which come into contact during running on curves.

Mr. Van Waefelghem (in French). — I should like to make one remark on the subject of this article. It is stated : « With a view to reducing lateral wear on curves, an endeavour should be made to perfect and develop appliances for lubricating the lateral faces of the head of the rail. » I admit that this is a means of reducing lateral wear, but I wonder whether, by thus enunciating the principle, other means, such as for example, the use of rails of special steel or heat-treated rails, will not be left out ?

As it stands, I consider the wording of this article to be too narrow.

Mr. Cambournac (in French). — The text might be worded as follows : « With a view to reducing the lateral wear on curves, the tests on heat-treated rails and rails of special steel should be continued on the one hand, and on the other, an endeavour should be made to perfect and develop appliances for... etc. »

Mr. Van Waefelghem (in French). — Agreed.

Mr. Carpmael. — May I point out that if the hardness of the rail is increased, it will increase the wear on the tyres. In the United States of America two effects are found *i. e.*, the saving of wear on the tyres and on the rails, and these two points should not be confused.

Mr. Cambournac (in French). — The proposal which has just been made expresses the anxiety of our colleague Dr. Matsunawa, but the tests which have

been carried out in Japan would appear to show, contrary to what Mr. Carpmael believes, that on curves the wear in the rails and tyres diminishes when the tyre is harder.

I should have no objection, moreover, to the inclusion in the text, with a view to elucidating the question for the future, of a phrase like : « It is desirable to inquire into the best carbon content to be adopted for the steel of the wheel tyres. »

The President. — I should like to point out that the question of tyres is outside the scope of the subject we are discussing.

Mr. Cambournac (in French). — That is correct, the question of tyres is outside our province, but if the Permanent Way Section is never going to consider questions relating to the tyres, and if the Locomotive and Rolling Stock Section is never going to consider questions relating to rails, it will never be possible to investigate in common improvements in the stock, unless a new Section is formed so as to act as a connecting link between the two.

The President. — I wish to separate what concerns the tyre from what concerns the rails and I propose that the paragraph should be adopted as worded in Mr. Cambournac's special report, with the addition : « or special or heat-treated rails should be used » without any modification.

— Carried.

Article 9 :

With a view to reducing wear through hammering at gaps in points and crossings, it is reommended that use should be made, in the details of such equipment, of manganese or nickel-chrome steel.

— Adopted.

Article 10 :

With a view to remedying wear due to rusting, it is recommended that a reinforced cross section be adopted. The tests with steel containing an admixture (0.3 %) of copper should be continued.

— Adopted.

Article 11.:

It is desirable that all railways should continue and develop the comparative tests of rail joints suggested by the London Congress, and that they should extend these tests to the following two new types of joint :

— head-free fish-plate;

— chevron fish-plate.

— Adopted.

Article 12 :

It is recommended that each administration should keep statistics relative to the breakage of the different types of fish-plates used in the comparative tests.

— Adopted.

Mr. Coullié (in French). — I should have liked to have said a few more words on the subject of article 11, and particularly regarding the type of fish-plate which is recommended under the name « chevron fish-plate, » and which has been tried out on the Midi Railway and at the present time on a large scale.

This type of fish-plate is the result of investigations which have been made on the Midi Railway, with a view to ensuring that the joints keep tight satisfactorily.

In ordinary fish-plates, the energy ex-

pended in tightening, if one may so call it, is stored up in the body of the bolts and in the small accessory parts, the washers, plates and other elastic parts which are intended to receive this energy and to transmit it further. It frequently happens, however, that this energy disappears very rapidly and after but a few days we find joints which are not tight. It has been proposed to have frequent tours of inspection for tightening the joints but the result has always been unsatisfactory.

We have endeavoured to cause the elasticity of the rail itself to take part in the tightening. The chevron fish-plate bears on the rail at two points : one point on the upper bull-head quite near the joint, and another point on the lower bull-head at a certain distance from the joint. A couple is produced, which tends to deform the rail in the vertical plane. For this couple to be sufficient, the distance or the lever arm should be fairly short so that a powerful straightening stress is obtained.

We have a practical method of checking the results obtained. This consists in measuring the electrical resistance of the joint. Tests have been made on ordinary fish-plates in service. The old fish-plates of whatever type always give an infinite resistance.

The same test has been made on chevron fish-plates put in the track, and is was found that the electrical resistance remained low even after long use.

In this way we have been able to discover a property of extreme interest for an electrified railway like ours. Previously, in order to ensure return of the current, we used copper bonds, which had the serious disadvantage of being very expensive, but now we have been able to discard these connections entirely and to replace the fish-plates previously in service by these chevron fish-plates, which weigh 4 kgr. (8. 8 lb.), whereas the ordinary fish-plate weighs 16 or 17 kgr. (35 to 37.5 lb.)

The result is that we have saved about 50 francs on each joint. Since at the present time we have put 100 000 pairs of this type of fish-plate into service, I leave you to judge of the saving we have effected. Of course, we are dealing with trials of recent date. It is about 4 years since this type of fish-plate was first in the tracks, but since that time we have not yet had any difficulties.

On the first trial lengths, up to the present about 60 000 trains have passed. The result is therefore already of interest, since after the passage of such a considerable number of trains we find it has been obtained without involving any abnormal maintenance expenses.

I wanted you to know this result before we separate although the hour is late, and I thank you for having so kindly waited to hear it.

The President. — The question on the agenda for to-morrow's meeting is as follows : « Investigation into the static and dynamic stresses in railway bridges .» I should like to remark that Mr. Swain, engineer of the East Indian Railway has left on the table some documents, and everyone who wishes may take a copy.

— The Meeting then closed.

DISCUSSION AT THE GENERAL MEETING.

Meeting on 10 May 1930 (morning).

PRESIDENT : Mr. José GAYTAN DE AYALA.

GENERAL SECRETARIES : Messrs. P. GHILAIN and A. KRAHE.

ASSISTANT GENERAL SECRETARIES : Sir HENRY FOWLER, K. B. E., Messrs. P. WOLF and J. M. GARCIA-LOMAS.

Mr. Ghilain, *General Secretary* (in French). — We shall now proceed to question II of Section I. Have any of the delegates anything to say with regard to the wording of the text as inserted in the *Journal of the Session ?*

Mr. Desprets (in French). — An error has crept into the wording of paragraph 5, article *a*) ; actually, only the first part of the text was approved and the second was allowed to drop.

Mr. Ghilain (in French). — Has anyone anything to say regarding this statement ?

Mr. Van Waefelghem (in French). — There is another slight error in article 6; it should be « the length of medium rails (of medium weight) » and in article 7 it has been overlooked that the summaries should mention that the use of special steels or heat-treated rails has been recommended for reducing lateral wear of the rails.

Mr. Ghilain (in French). — Has anyone any remarks to make regarding the modifications to the text which have just been noted ? If there are no remarks on the subject of these modifications, they will be considered as adopted.

The President. — The summary is as follows :

Summary.

« 1. It is desirable to continue the pub-
« lication of data relative to rail break-
« ages under the conditions laid down at
« the London Congress, the tables, how-
« ever, being slightly modified.

« 2. It is highly desirable to continue
« the observation and study of rail break-
« ages, and it is recommended that this
« should be done in collaboration with
« metallurgical engineers.

« 3. It is desirable that the precautions
« indicated below should be observed in
« the manufacture of rails :

« *a*) dose the steel in such a way as to
« avoid blow-holes;

« *b*) forbid the use of bottom plates at
« the bottom of the ingot moulds;

« *c*) avoid splashes when pouring;

« *d*) not to roll ingots too hot;

« *e*) not to force the speed when « blooming, so as to avoid the formation « of cracks;

« *f*) discard from the ingots the part « affected by piping and segregation;

« *g*) terminate rolling at a temperature « as near as possible to that of the cri- « tical point;

« *h*) establish and maintain the pro- « file of the grooves on the rolls with « accuracy;

« *i*) reduce to a minimum the cold « straightening of rails, so as to diminish « the stresses resulting therefrom.

« 4. It is recommended that the follow- « ing should be developed :

« *a*) elasticity tests for determining the « homogeneity of the cross section. In « their present form, these tests can be « used for elimination purposes, *i. e.* for « the elimination of rails which are not « uniform throughout;

« *b*) elasticity tests for determining the « degree of fragility of the metal. These « tests, in their present form, do not en- « able fragile rails to be rejected, but « they are already sufficient to serve as « a basis for the granting of quality pre- « miums. It would be an advantage if « research could be continued in order « to perfect a fragility test applicable to « the whole cross section of the rail;

« *c*) laboratory research and tests rela- « tive to the endurance of rails, *i. e.* to « their resistance to repeated stresses;

« *d*) research and experiments relative « to the stresses which develop in rails « under passing wheels.

« 5. The following precautions are re- « commended when laying rails :

« *a*) to utilise rails obtained from the « head of ingots in those parts of the « line which are least heavily stressed;

« *b*) to load and unload rails by me- « chanical means;

« *c*) to inspect the rails in situ, at least « once a year, on lines where traffic is « intense. It is desirable to perfect ap- « pliances for detecting internal defects « in rails whilst in service (Sperry detec- « tor, Suzuki defectoscope);

« *d*) to use rails which have received « suitable heat treatment on sections of « line where the rails are subjected to ex- « ceptional stresses, to skidding and to re- « peated braking, as rails so treated resist « the propagation of superficial fissures « (cracks in the running surface) better « than rails which have not been treated.

« 6. The length of medium rails (of « medium weight) can, without inconve- « nience, be increased to 24 m. (78 ft. « 9 in.), and research and tests should « be continued with a view to increasing « the length beyond 24 metres (if neces- « sary by means of aluminothermic weld- « ing), particularly at special points of « the line where the effects of expansion « are less to be feared.

« 7. With a view to reducing normal « wear in rails, it appears desirable to « give the running surface, when new, « the average cross section which it tends « to assume in service.

« 8. With a view to reducing lateral « wear on curves, appliances for lubricat- « ing the lateral faces of the head of the « rail and of the wheel tyre which come « into contact during running on curves, « should be perfected and developed, or « special or heat treated steel rails should « be used.

« 9. With a view to reducing wear « through hammerings at gaps in points

« and crossings, it is recommended that « use should be made, in the details of « such equipment, of manganese or nickel-chrome steel.

« 10. With a view to remedying wear « due to rusting, it is recommended that « a reinforced cross section be adopted. « The tests with steel containing an admixture (0.3 %) of copper should be « continued.

« 11. It is desirable that all railways « should continue and develop the comparative tests of rail joints suggested « by the London Congress, and that they « should extend these tests to the following two new types of joint :

« — head-free fish-plate;

« — chevron fish-plate.

« 12. It is recommended that each administration should keep statistics relative to the breakage of the different « types of fish-plates used in comparative tests. »

— This summary is adopted by the General Meeting.

APPENDIX

NAMES OF ADMINISTRATIONS AND DESCRIPTION OF RAILS.	AGE					
	Less than 5 years.			5 to 10 years.		
	Number of fractures.	Length of single track of this class.	Number of fractures per 1 000 km. or per 625 miles.	Number of fractures.	Length of single track of this class.	Number of fractures per 1 000 km. or per 625 miles
1	2	3	4	5	6	7
Railway :						
A. — Rails no						
Light rails : of a weight less than 42.5 kgr. per metre or 85 lb. per yard .						
Medium rails : of 42.5 kgr. to 52.5 kgr. per metre or 85 to 105 lb. per yard						
Heavy rails : of a weight equal to or greater than 53 kgr. per metre or 106 lb. per yard.						
Total. . . .						
B. — Rail						
Light rails : of a weight less than 42.5 kgr. per metre or 85 lb. per yard .						
Medium rails : of 42.5 kgr. to 52.5 kgr. per metre or 85 to 105 lb. per yard.						
Heavy rails : of a weight equal to or greater than 53 kgr. per metre or 106 lb. per yard.						
Total. . . .						
C. — Tota						
Light rails : of a weight less than 42.5 kgr. per metre or 85 lb. per yard .						
Medium rails : of 42.5 kgr. to 52.5 kgr. per metre or 85 to 105 lb. per yard						
Heavy rails : of a weight equal to or greater than 53 kgr. per metre or 106 lb. per yard.						
Total. . . .						
Number of { train-kilometres / train-miles }						
Number of { tonne-kilometres / English ton-miles }						

AILS

10 to 15 years.		15 to 20 years.			Over 20 years.			The whole of the rails.			Maximum axle weight.
Length of single track of this class.	Number of fractures per 1 000 km. or per 625 miles.	Number of fractures.	Length of single track of this class.	Number of fractures per 1 000 km. or per 625 miles.	Number of fractures.	Length of single track of this class.	Number of fractures per 1 000 km. or per 625 miles.	Number of fractures.	Length of single track.	Number of fractures per 1 000 km, or per 625 miles.	
9	10	11	12	13	14	15	16	17	18	19	20

nnel.

nnel.

and B.

Total		
ber of fractures	per 10 000 000 train-kilometres or per 6 250 000 train-miles	
	per 1 000 000 000 tonne-kilometres or per 612 000 000 English ton-miles	

		PERCENTAGE OF FRACTURES IN THE PART		NUMBER OF FRACTURES				
		covered by the fishplates.	clear of the fishplates.	on straight lines or curves of > 800 mètres (40 chains) radius.	on curves of ≤ 800 metres (40 chains) radius.		on a rising or falling gradient	
					Lower rail.	Higher rail.	≤ 10 mm. per metre (1 in. 100).	> 10 mm. per metre (1 in 100).
D.	Light rails . . .							
	Medium rails . .							
	Heavy rails . . .							
	TOTAL. . .							
	Miles of single track of each class . .							

E. —			Light rails.	Medium rails.	Heavy rails.
a) New clean fractures	with internal transverse fissure				
	without internal transverse fissure				
b) Fractures with much rusted old part, extending to the outer surface of the foot or the head	in the foot				
	in the head				
c) Fractures with much rusted old part, *not* extending to the outer surface of the foot or the head	in the web				

[624. 2 (01]

QUESTION III.

INVESTIGATION INTO THE STATIC AND DYNAMIC STRESSES IN RAILWAY BRIDGES.

Preliminary documents.

1st Report (America), by Mr. P. G. Lang, Jr. (See *Bulletin,* May 1929, p. 502 or separate issue No. 3.)

2nd Report (the British Empire, China and Japan), by Sir Henry Fowler, K. B. E., and Mr. G. Ellson. (See *Bulletin,* July 1929, p. 859 or separate issue No. 8.)

3rd Report (Belgium, France and their Colonies), by Messrs. A. A. C. Ronsse and R. Despretes. (See *Bulletin,* December 1929, p. 3103 or separate issue No. 48.)

4th Report (other countries), by Mr. A. Fava. (See *Bulletin,* December 1929, p. 3129 or separate issue No. 49.)

Special Reporter : Mr. R. Despretes. (See *Bulletin,* May 1930, p. 1379.)

DISCUSSION BY THE SECTION.

Meeting of the 9 May 1930 (morning).

Sir Charles L. MORGAN, C. B. E., in the Chair.

At 9.30 a. m., the **President** of the Section declares the meeting open for discussion and calls upon Mr. Despretes, *Principal Secretary,* and *Special Reporter* on Question III.

Mr. Despretes (in French). — Before beginning the discussion on what might be called the summaries of Question III — if it were possible to formulate conclusions for this particular question — I should like to read a short, concise statement, outlining approximately the scope and above all the origin of the question.

The question of dynamic stresses in metal rail bridges which we are to consider this morning, although little known, nevertheless dates back almost to the commencement of metal bridge construction. As long ago as 1849 the Government of Queen Victoria nominated a

commission to examine the effects of speed and the impact of running loads on the metal bridges. From the mathematical and experimental points of view this period is marked by the names of Stokes, Hodgkinson, Tredgold, etc.

At that time great importance was attached to the effects of centrifugal force and of speed proper. French engineers, among whom mention may be made of Philipps, Renaudot, Bresse, Résal and Souleyre, also made important mathematical contributions to the study of the question.

It is, however, only within recent years, and in the Anglo-Saxon countries, that the importance of the question has been fully realised and that experimental research has been undertaken on a large scale with the object of determining the dynamic increase of stresses and tensions. We are familiar with the American formulæ of Pencoyd and Waddell.

The Americans were the first, so far as I am aware, to draw attention to the importance of the loads produced at the critical speed by the excess counterbalance weights of locomotives. When the locomotive is well balanced, it is evidently only a question of the supplementary counterbalance weight intended to absorb the forces of inertia of the reciprocating parts. This is the effect known in English-speaking countries as « hammer blow ».

The American Railway Association nominated a commission which, some fifteen years ago, issued an important report. Reference should also be made to the reports of the commissions of the Indian and English railways and, finally, to the very important English report of the Bridge Stress Committee.

Other tests and trials have been undertaken in other countries, e. g. Switzerland, Russia and Germany. One would imagine that after all this experimenting and research the question must have been solved. This, however, is far from being the case. I, for my part, attribute the lack of success partly to the complexity of the problem, which depends upon both rolling stock and track and the mutual relationship between the two. On the other hand, I attribute it equally, I must admit, to the fact that none of the tests have been conducted in the scientific spirit.

The nineteenth century and the very rudiments of mathematics teach us that in order to determine an element it is necessary to isolate it and to transform it into a known function of the variable factors. Instead of that, the investigator has generally contented himself with plotting a graph and, among his constellation of dots, tracing a curve which may mean anything desired.

It must, however, be recognised that the last English report indicates a praiseworthy effort at precision, while allowing a necessarily wide margin for the unknown. It is based on the mathematical researches of Professor Inglis of Cambridge, who was preceded in this sphere by Professor Timoshenko, the real creator of the scientific theory of impact.

As I have pointed out in my special report, it is at present difficult to advocate any one formula rather than another. All contain a wide margin of uncertainty. The final problem is, moreover, to determine the cross section of a structural part. This cross section depends on the tension in the member and the allowable working stress. Taking, into account these two related factors, I have shewn that the results obtained by the French and German formulæ are practically identical. What one can do is to deal with the causes of impact and, among

those causes, the rail joint and the variable elasticity of the flooring. It is also equally desirable to devote great attention to the balancing of locomotives. In this connection I have drawn attention to a new factor in the question : the grouping of locomotive axles. I have shewn that by simplifying the final equations it would be possible to represent the effect of an isolated counterbalance weight by a periodic function. The stresses created by the different axles compensate one another and this compensation, established in accordance with Fresnel's rule, indicates that for bridges of sufficient span the grouping of three axles would be almost perfect — groups of 2, 4, 5 axles being equivalent to the effect of a single axle. This is an important point which should be made the subject of experiment.

I also consider, following the lead set by Russian researches, that there remains open a vast field for investigations as regards auscultation of bridges, determination of critical speeds and speeds at which vibrations damp out. This is the physiological aspect of bridge construction, and the object is to arrive at what we may call its medical diagnosis.

I will now read what might be called the summary :

« The use of the ordinary formulæ of the best known regulations — French formula — German formula — leads to results which do not differ much.

« Is it necessary, as done by the English Regulations, to compile special tables of the loads for each span, taking into account the effect to the excess counterbalance weight almost exclusively ? In our opinion, to do so is to complicate needlessly the applications, and by desiring to be too strict on one point, to run the risk of overlooking others of more importance.

« In the present state of the researches, it is impossible to recommend any formula in comparison with the others — they must be used with judgment, and above all, care should be taken not to give them a too exact meaning.

« With regard to the causes of impact, theoretical considerations and the experience gained indicate certain particular precautions to be observed :

« 1. Care should be taken that the treads of the wheel tyres are regular — flats capable of serious damage should be avoided.

« 2. Particular care should be paid to the upkeep of the track on the bridge floor and at the approaches.

« Care should be taken that the joints of the rails are kept in order — if possible they should be placed off the bridge, at all events as close as possible to the supports. The trials of welding the joints on bridges will be followed with interest, this measure, if successful, being extremely favourable to the reduction of impact.

« It is also advisable to strengthen the sections of the track at the approaches to bridges, so as to avoid rapid variations of the equilibrium of the locomotive on its springs.

« 3. The influence of the excess counterbalance weights of locomotives should be diminished by distributing the weights between groups of three adjacent coupled axles.

« In addition to these conclusions of a practical character, it is obvious that one cannot but encourage the thorough researches of the Companies to help forward the investigation of the phenomena and the measurement of their maximum effects. At this limit, the problem becomes difficult and demands the collaboration of the most capable mathematical and technical knowledge. The remark will certainly be made that the bridges have stood up and still do so. The answer to this objection is that loads have never been as heavy or as

fast as at present; moreover, numerous examples could be given from actual practice, in which the introduction of greater speeds has given rise to fresh problems and has created the need for fresh solutions. »

Mr. Swain, East Indian Railway. — Mr. Desprets' summary of the four reports drawn up by the special reporters on this subject is, I think, a fairly just statement of the conclusions which may be drawn from the evidence of those reports. Unfortunately it leaves the subject in a nebulous state and affords little guidance for the bridge engineer who has to deal with the practical problem of making a definite allowance for the dynamic increment when designing his bridges. Something in the nature of a definite working formula is required, and, personally I believe there is already a sufficient amount of evidence as regards the proper impact allowance on spans of moderate and larger size. I believe that the Indian covering formula published by the Railway Board of India in 1926 is entirely satisfactory, and gives the proper allowance which is required.

That formula is shewn on the smallest of the three charts which I have had prepared for distribution to members attending this subject. The two larger charts are a justification of the Indian formula in the case of two typical spans, namely, one of 157 feet and one of 213 feet, which have been tested by the heaviest test train available in India, the engines employed being heavy and at the same time of a high « hammer blow ». In each case are reproduced on the sheet the actual deflectometer diagrams obtained by running the test train over the span at increasing speeds. In each case the critical speed is shewn by the diagram which has the largest vertical oscillations super-imposed on the normal deflection. On the right of the sheet is shewn a comparison of :

1. the impact by actual test at critical speed (which is the half amplitude of the vibration expressed as a percentage of the static deflection);

2. the impact calculated by the Indian basic formula for the conditions of the case;

3. the impact calculated by the Indian covering formula $\frac{65}{45+L}$ which we employ to cover what may be expected under any range of tests or conditions other than those of any particular test. The Indian covering formula gives an allowance for impact which is close to reality. Plotted on a span basis, it is a hyperbola which has been drawn over the maximum basic impact effects on various spans, and, excepting in the case of short spans, it is not an empirical formula. On the other hand, although expressed in terms of span (in feet) only, it in reality contains the elements of « hammer blow », dead weight of structure, live load of train, circumference of engine driving wheels and finally stiffness of the girders as given by their static deflection under the train load. Actually its mathematical basis has been checked against a very large amount of other experimental evidence, the two particular cases put up being merely illustrative. The Indian basic formula on which the covering formula is based is closely allied to the conclusions of the English Bridge Stress Committee's report, although independently produced. The covering formula is closely in agreement with the French formula; in fact, I think one can say that on the larger spans the agreement is remarkable. The greatest

divergence is in the region of short spans. In that region we admit that the formula is empirical. Further, I believe that for the purpose of short spans it must remain empirical. On short spans the actual amount of allowance made will not depend so much on the engine hammer blow, but rather on empirical factors arising from the condition of the track and rolling stock, also of the bearings of the girders. To attempt therefore a scientific solution covering these factors will indeed be difficult if not impossible. I believe that the careful tests on the Swiss Federal Railways with electric locomotives have shewn that a high empirical allowance is required.

In India further experiments are being made on short spans and some further evidence may come to light. In the meantime, we believe that the covering formula $\frac{65}{45 + L}$ is entirely satisfactory for general adoption.

Mr. Fava, *Reporter* (in French). — Question III, as formulated, concerns not only dynamic but also static stresses.

From the practical point of view, that is to say of the engineers responsible for bridge construction and still more of those who have to judge as to the capacity of old bridges to stand the constantly increasing loads, the exact determination of *effective* static stresses, taking into account the so called secondary stresses, is of great importance.

We know, in fact, that in certain cases these secondary stresses are very high in relation to the principal stresses, so that, as I have shewn in my report, when it is desired to check experimentally stresses calculated by means of the ordinary process, it may indeed happen that changes of the type of stress are noticed, for example, one may find compression stresses whereas, according to the ordinary calculations, there should be tensile stresses, and conversely.

I think, therefore, that it would be useful to formulate some conclusions on the subject of static stresses and secondary stresses.

Mr. Everall (North Western Railway, India). — My colleague, Mr. Swain, has described the basic and covering impact formulæ now adopted by railways in India and their close agreement with results obtained in practice for medium and large span bridges.

I am in full agreement with Mr. Swain's remarks. It is, however, in connection with small spans and flooring systems of large bridges that conditions are more variable. There are so many empirical conditions that form the larger proportion of the dynamic increase of stress.

It has been found, for example, that electric and well balanced locomotives cause disturbing effects in small girder units as great as those caused by unbalanced locomotives.

An extensive series of tests and investigations on small bridges recently made on the Swiss Federal Railways, confirms this.

These disturbances are difficult to explain, they may be due partly to excessive nosing and rolling load effects.

Further in the flooring of a bridge forming an integral part of the whole structure (that is where the component parts are suitably attached by riveted connections throughout) the dynamic stresses set up are very complicated; this is largely due to the interaction of the floor with the main girders.

Frequently synchronism of the main girder vibrations are found in the flooring, increasing the dynamic effects to a much larger extent than is usually found

in freely supported girders of similar dimensions.

The subject calls for further investigations. I therefore suggest that a fruitful field of work will be to make further records and investigation into the dynamic stresses :

1. Caused by the disturbing effects of electric and heavy well balanced locomotives on bridges. especially in small spans and floor systems.

2. Due to the disturbing effects set up in the flooring system of bridges where the floor members form an integral part of the whole structure, and interaction of stresses takes place with the main girders.

Mr. Fraser, London & North Eastern Ry. — The question of the impact effect on the stresses on bridges has been very much to the fore for a number of years, not only from the point of view of the design of new bridges, but also in relation to existing bridges.

A number of years ago I had the honour of being elected a member of a Committee appointed by the Ministry of Transport for Great Britain to consider the redrafting of the existing rules and regulations for the working of railways, part of the work being the amount of impact which should be allowed in the calculations for new bridges. At that time the Committee had considerable difficulty in arranging a suitable impact formula. It was eventually decided that a number of experiments on existing bridges should be carried out with the Fereday-Palmer stress recorder. The curves obtained from these varied considerably, especially in small spans, from the curves obtained by the Pencoyd and other formulæ. The Committee, in adopting a curve of impact based on the results of the experiments, thought it advisable to point out that the curve was to be considered as only provisional until such time as further experiments could be carried out.

It was anticipated that the new curve would raise considerable criticism and in this respect the Committee was not disappointed. I think that one result of the publication of the Ministry of Transport curve is the increased interest which has been taken in the question of impact, and I am sure the members of the Congress are all congnizant of the report of the Bridge Stress Committee of the Department of Scientific and Industrial Research of my country. The work of that Committee is altogether magnificent and has taught us a great deal more about impact than we had known previously.

After my experience on the Ministry of Transport Committee, I felt that it would be of considerable interest if experiments were carried out on the bridges under my charge on the railway with which I am connected. A large number of these experiments were carried out and the general conclusion I came to was that the actual stresses were less than those obtained by calculation. I also found that, by assuming a certain amount of distribution of the load between different members, the calculated stresses in a large number of bridges could be got to approximate to the actual stresses, although, in some bridges, owing to indeterminate factors, it was not always possible to do this.

Mr. Ellson, *Reporter*, who is unable to attend the Session, has sent the following note :

Impact allowances in small spans.

One of the features of the Bridge

Stress Committee's recommendations which has been subject to a certain amount of criticism is their recommendation in regard to impact in short spans and on floor members of spans in general.

1. *The effect of hammer blow.*

This presented no difficulty and the recommendations have not been disputed. In small spans the hammer blow effect can be calculated for any engine if the amounts and positions of the counter-balance weights are known, and the effect is independent of the type of bridge.

2. *Rail joint effect.*

A very large number of records taken on some 50 bridges were examined in order to ascertain the greatest effects due to rail joints and other irregularities of track. Very many records taken by stress recorders were discarded as they clearly showed effects due to intrumental errors.

The Committee's recommendations were very carefully considered as the result of prolonged experiments made both in the Engineering Laboratory at Cambridge and in the field, and are considered to give covering allowances for bridges in England.

3. *Lurching.*

The Committee's recommendation in regard to lurching was based on the same procedure as their recommendation for track effects and is equally comprehensive.

General application of recommendations.

It must be borne in mind that the Bridge Stress Committee's work was carried out on bridges in this country (England) and although a very wide range and variety of types of bridges were tested it is quite possible that similar experiments in other countries where either the bridge or the type of permanent way upon it is different, might yield somewhat different results.

Sir Henry Fowler, *Reporter.* — I regret that unfortunately owing to various reasons I am the only Member of the British Bridge Stress Committee present at the Congress. I am also the only locomotive engineeer who was on that Committee. British locomotive engineers feel very strongly that this is a matter of the greatest possible importance. They are very thankful that as a result of the work of that Bridge Stress Committee they have been allowed a somewhat greater weight on locomotive axles than had been allowed in times past. It was not until these investigations were made that the civil engineers have asked the locomotive engineers to consider as closely as they are doing now the question of « hammer blow », or dynamic effect of locomotives on their structures. Still, we have great difficulty with regard to locomotives with two cylinders, and I trust that some of our colleagues from America, both the U. S. A. and Canada, will be able to tell us how they are able to use locomotives with two cylinders placed outside the frames and of large size without developing a very large hammer blow and therefore dynamic stress upon the bridge. The Report of the Bridge Stress Committee has undoubtedly turned the attention of locomotive engineers to the advantages which arise from utilising three or four cylinders, and by that means practically eliminating hammer blow. I shall feel obliged for any information in addition to what has been published in the reports with regard to special materials for reciprocating parts. We

are using, to a greater extent, special alloy steels and I hope to be able to extend their use even more than I have done. I want very much to be able to use a piston made of aluminium, or some other light alloy. Unfortunately in doing this, one is up against difficulties. I have made several experiments in this direction, and the result was in one case that when we opened up the cylinder the piston had disappeared altogether, and in another case, with a different alloy, the piston was found to be completely broken up. With the use of superheated steam, there is a difficulty in the employment of a very light alloy, but I hope that something more may be done by the utilisation not only of alloy steel but of others of the so-called light alloys.

With regard to the British Bridge Stress Committee there is one thing at which we, as locomotive engineers, are somewhat surprised. It is the investigation of Professor Inglis with regard to the effect of springs. I naturally have assisted not on the mathematical side but on the practical side of that work. It seems astonishing to us that if we have a spring which functions well at certain speeds, that spring is not an advantage from a stress standpoint. Notes have been made on page 109 of the Bridge Stress Committee's Report on the subject of lurching, which my colleague, Mr. Ellson, has also referred to, and I feel there is opportunity for further practical experiments in spite of that very close co-ordination between the theory and practical results which are shewn on figure 57 of the Bridge Stress Committee. I feel strongly also that from every standpoint, it is a point which may receive further consideration, and particularly the co-ordination between the effect of the locomotive and the state of the road which causes lurching to take place.

Mr. Desprets both in his paper and in his special report has laid great stress upon the question of flats on tyres. We all no doubt have certain points on which we are, as the saying goes, « mad », and the question of tyres is one to which I pay special attention. I never go into a large or small shop without looking at the tyres of locomotives in service, and I want to say that as far as the London Midland & Scottish Railway locomotives are concerned, — and we have about 10 000 — we have, practically speaking, no flats on our tyres. This is probably due to the fact that the gradients in England are not so steep or so long as those of many other countries.

I am afraid I do not fully appreciate Mr. Desprets' argument with regard to a six-wheeled coupled engine being more advantageous than an eight or ten-coupled one from a balancing and hammer blow standpoint. Doubtless it is a matter on which I may receive enlightenment during the discussion. We appreciate very much the tables which Mr. Fava has given in his report, and which will be of great assistance.

Mr. Desprets (in French). — I have the impression that the role played by springs is being somewhat exaggerated. I shall have to look carefully to my conclusions on the grouping of axles if the flexibility of springs is to be brought into account.

It may be noted that the English report considers only vertical displacement of the locomotive as a whole. There are, however, many other parasitic movements, which have been interpreted by Herdner on the theory of the elastic centre.

Mr. de Boulongne, Paris, Lyons & Mediterranean Ry. (in French). — Dynamic stresses are very difficult to calculate.

These stresses are, however, very important in the case of small structures and as regards the different parts of the flooring of average and large size structures.

During the last fifteen years, the Paris, Lyons & Mediterranean Company — where for more than thirty years I have been connected with metal construction work — has in practice increasingly favoured the laying of tracks on ballast, even on metal structures.

In the case of small spans we have built many bridges of rolled sections embedded in concrete and covered with ballast.

In the case of very large bridges which it would otherwise have been necessary to reconstruct in view of the increasing weight of locomotives, we have strengthened them in several cases by reinforced concrete additions carrying the ballast, with excellent results from the technical point of view, and with an expenditure of only half of what it would have cost to build entirely new bridges.

In the last eight years we have in this way saved over twelve million francs.

In conclusion, the introduction of a layer of ballast between the track and the metallic flooring appears to be the best method yet discovered of diminishing dynamic stresses.

Mr. Newlands, London Midland & Scottish Ry., speaks or the importance of the subject from his standpoint, and the advantages which they are able to take with the results already obtained in allowing for impact on the structures. He further said: — The new light being thrown on this old problem of impact appears to be proceeding along proper lines, in that impact as such has now been split up into its component parts, that is, hammer blow, lurching, rail joint, etc. In the past, one formula after another has been produced and afterwards rejected. I feel now that we are getting nearer the correct solution of the problem. I am interested to hear what my colleague, Sir Henry Fowler, says on the subject of lurching, but I wish to join issue with him when he alleges that lurching is a consequence of bad track. I do not agree with this; there are engines — but not all engines — that lurch of their own accord when running at speed. I am glad to find that in locomotive design the question of the total load distribution through all the axles is receiving the consideration it should. I am very glad too that the question of the springs on the locomotive, and their action, has been mentioned. I am always a little doubtful as to what the variation in axle loads may be when running at high speeds owing to the action of the springs. Are the weights which I, as an engineer, am given, and have to work to, those which actually occur when a locomotive is running at high speeds? Lurching, rolling, and pitching, I feel, are to some extent at least due to some form of abnormality, in certain engines at all events. I like Mr. Desprets' description of vibrations, pitching, rolling, hunting, etc., as being *parasitic movements*, as I feel this correctly describes them.

I have in times past accepted the best formula with caution, and I think that I have some justification for continuing this. Much as I appreciate the work done by the British Bridge Stress Committee, I wonder how long their results will be accepted without challenge.

I feel that much knowledge is highly desirable with regard to the actual relations between wheel and rail at speed. I have seen some excellent photographs

taken with a cinema camera of wagon wheels while travelling, and I am pleased that my friend Fowler has done some work in the same direction with regard to a locomotive. Although this work at present is not very far advanced and is really still in development, what I have seen justifies the hope that valuable results will be achieved by this means.

The President. — As there are no other speakers, the moment has come to adopt a draft summary relative to the question which we are considering.

Mr. Desprets (in French). — With the permission of the President, I propose to give in French my suggestions with regard to the draft summary. I think that in the first place we should come to a decision with regard to the suggestion put forward by Mr. Fava. He points out that the wording of the question mentions not only dynamic but also static stresses.

Most of the reporters have dealt with the question of dynamic stresses because that is the question with which we are chiefly preoccupied. The question of static stresses arises rather in connection with that of the resistance of materials, and, if I may be permitted to give my point of view on this subject, I think that in recent years there has been a tendency unduly to exaggerate the role of what we have called secondary stresses. Secondary stresses are of two very distinct categories; they arise in the first place in bridges from eccentricity in the girders and fastenings; their influence upon the girder is represented by a bending movement determined by the product of the stress in the girder and its eccentricity.

Then there are secondary stresses arising from the rigidity of the joints; these are what have been very appropriately termed « self-relieving stresses ». In fact, if it be imagined that the joint undergoes a very slight deformation, the stresses in question gradually disappear during the process of deformation; if, moreover, we suppose for a moment that the girder elements are reduced to threads without inertia of their own, the secondary stresses disappear.

Among the calculations and researches which have been made from this point of view, mention should be made in the first place of the American investigations. The American Railway Association several years before the war nominated a Commission for the purpose of investigating the subject of secondary stresses, and the most definite result achieved in the Commission's report was to relate secondary stresses to the ratio between the width and the length. That goes almost without saying : the secondary stresses will be the weaker in proportion as the ratio of the width of the element to its length is lower, which indicates a lower linear inertia.

In the second place, research has been carried out by the Swiss Commission, which has demonstrated in its conclusions that the secondary stresses, in the most important cases encountered in actual working, did not exceed 10 to 15 % of the principal stresses.

I would further mention in this connection the French regulations for metal bridge designing, which assume stresses of 10 %.

Is it necessary to introduce secondary stresses into our final summary ?

The two questions are absolutely distinct. Secondary stresses are of a purely static character, whereas we have always had in view the question of dynamic stresses, as this is the question which interests us the most.

Mr. Lévy, *Vice-president* (in French). — I consider that the two questions are quite distinct : that of dynamic stresses and that of static stresses, but the determination of secondary stresses is an important problem.

For this reason, therefore, I think it would not be without value if certain administrations would investigate this subject and report the results to the other administrations.

The President. — I will now put to the vote the suggestion of Mr. Fava and Mr. Lévy that we should include in the summary to Question III certain conclusions relating specially to secondary stresses and to static stresses.

— The Section adopts the following text :

« It is desirable that the railway companies should continue experiments and the study of secondary stresses, with a view to furnishing supplementary information on the occasion of another Railway Congress. »

Mr. Swain. — I venture to insist that we should give a definite and precise formula for the variation of dynamic stresses.

Mr. Desprets (in French). — For my part I do not think it possible, as our understanding of the problem is not yet sufficiently advanced.

Mr. Ronsse, *Reporter*. — I see no objection to the suggested addition; it will not commit us to one or the other formula; the proposal is merely that we should express the desirability of seeking a definite formula; it seems to me that this is indeed the object of the researches which we propose to pursue. I must remark that on the Continent methodical tests have only just been begun. Together with other engineers of Continental railways I have followed these tests very closely. From the outset considerable difficulties have been encountered : The question of apparatus is one of the points to which I would draw particular attention; it has been found that there is no absolute certitude as to agreement between the actual dynamic stresses and the stresses indicated by the recording instruments; it has even been remarked that instruments merely laid down loose on the bridge gave certain indications on the passage of the locomotive used for the test. A whole series of preliminary researches has to be made, and in my opinion we are still only at the threshold of the question. Numerous methodical tests are necessary before a definite formula can be evolved.

Mr. Swain. — I would like to observe that the data given in the English report cannot assist us very much; at the end of that report bases of calculation are given, but these are tables which, in fact, can be used only by British engineers, and which do not admit of comparison being made with the results obtained by other formulæ. This is a very great disadvantage.

Mr. Desprets (in French). — I am entirely of your opinion. On the figures given in the English report it is extremely difficult, for instance, to distinguish between the stresses due to counterbalance weight and other stresses.

The President asks the Meeting to vote on the adoption or otherwise of Mr. Swain's proposed addition to the summary.

Mr. Swain. — I propose that the following be added to the summary :

« The advantages of eventually estab-

lishing and adopting a definite formula for the impact allowance in terms of the span in feet are such that it will greatly assist in the standardisation of bridge work. »

— On a show of hands this is adopted.

The President. — I will now put to the vote the first two clauses of the summary as drafted by the Special reporter :

« 1. Care should be taken that the treads of the wheel tyres are regular — flats capable of serious damage should be avoided.

« 2. Particular care should be paid to the upkeep of the track on the bridge floor and at the approaches.

« Care should be taken that the joints of the rails are kept in order — if possible they should be placed off the bridge, at all events as close as possible to the supports. The trials of welding the joints on bridges will be followed with interest, this measure, if successful, being extremely favourable to the reduction of impact.

« It is also advisable to strengthen the sections of the track at the approaches to bridges, so as to avoid rapid variations of the equilibrium of the locomotive on its springs. »

— These two clauses are adopted.

The President. — We will now take the third clause :

« 3. The influence of the excess counterbalance weights of locomotives should be diminished by distributing the weights between groups of three adjacent coupled axles. »

— That clause is adopted.

The President. — The discussion on question III is now closed. I am afraid, however, that the question we have dealt with, which was a very important one, has not received the discussion it merited owing to the extreme difficulty of understanding the technical terms in the languages which have been used.

DISCUSSION AT THE GENERAL MEETING.

Meeting on 10 May 1930 (morning).

PRESIDENT : Mr. José GAYTAN DE AYALA.

GENERAL SECRETARIES : Messrs. P. GHILAIN and A. KRAHE.

ASSISTANT GENERAL SECRETARIES : Sir Henry FOWLER, K. B. E., Messrs. P. WOLF and J. M. GARCIA-LOMAS.

Mr. Ghilain, *General Secretary*. — We now come to the summary to Question III, which has been published in the *Daily Journal of the Session*.

Are there any observations as regards the text ?

No one has any observations to make.

The President. — In that case the following text is regarded as approved :

Summary.

« 1. It is desirable that the railway « companies should continue experi- « ments and the study of secondary « stresses, with a view to furnishing « supplementary information on the « occasion of another Railway Congress.

« 2. The advantages of eventually es- « tablishing and adopting a definite for- « mula for the impact allowance in terms « of the span in metres (in feet) are that « it would assist greatly in the standar- « disation of bridge work.

« 3. Care should be taken that the « treads of the wheel tyres are regular « — flats capable of serious damage « should be avoided.

« 4. Particular care should be paid to « the upkeep of the track on the bridge « floor and at the approaches.

« Care should be taken that the joints « of the rails are kept in order — if « possible they should be placed off the « bridge, at all events as close as pos- « sible to the supports. The trials of « welding the joints on bridges will be « followed with interest, this measure, if « successful, being extremely favourable « to the reduction of impact.

« It is also advisable to strengthen the « sections of the track at the approaches « to bridges, so as to avoid rapid varia- « tions of the equilibrium of the loco- « motive on its springs.

« 5. The influence of the excess coun- « terbalance weights of locomotives « should be diminished by distributing « the weights between groups of three « adjacent coupled axles. »

[625 .172 & 625 .173]

QUESTION IV.

RECENT IMPROVEMENTS IN PERMANENT WAY TOOLS, AND IN THE SCIENTIFIC ORGANISATION OF MAINTENANCE WORK.

Preliminary documents.

1st Report (Belgium, France, Italy, Portugal, Spain and their Colonies), by Mr. D. MENDIZABAL. (See *Bulletin*, January 1930, p. 9 or separate issue No. 51.)

2nd Report (America, the British Empire, China and Japan), by Mr. Ch. H. J. DRIESSEN. (See *Bulletin*, February 1930, p. 385 or separate issue No. 58.)

3rd Report (other countries, except Germany), by Mr. J. HAUER. (See *Bulletin*, March 1930, p. 1029 or separate issue No. 70.)

4th Report (Germany), by Dr. Ing. MÜLLER. (See *Bulletin*, March 1930, p. 1079 or separate issue No. 71.)

Special Reporter : Mr. Ch. H. J. DRIESSEN. (See *Bulletin*, May 1930, p. 1556.)

DISCUSSION BY THE SECTION.

Meeting of the 12 May 1930 (morning).

SIR CHARLES L. MORGAN, C. B. E., IN THE CHAIR.

— The meeting opens at 9.30 a. m.

The President. — First of all, I wish to call the attention of the Section to the notice in the *Daily Journal of the Session* relating to the cinematograph film to be shewn to-day at 4 o'clock by Mr. Tettelin, of the French Nord Railway, in the Escuela de Ingenieros de Caminos, 3 and 5 Calle de Alfonso XII.

This film will show a new method of complete track renewal (rails, sleepers, ballast) on a main line by means of mechanical appliances used on the French Nord Railway since 1929, the daily output being 600 to 800 m. (1 970 to 2 625 feet) in eight hours' work.

We shall now pass on to the discussion of Question IV.

I is very desirable that the discussion on « Recent improvements in permanent way tools, and in the scientific organisation of maintenance work » should be as brief as possible, and that it should be completed in the morning meeting, to avoid coming back in the afternoon.

At the end of the discussion on Ques-

tion IV, we shall have to settle on the questions to be selected for the 1933 Congress. We have the option of four questions, and of these we have to select three.

I shall now call on **Mr. Driessen**, *Special reporter*.

Mr. Driessen (in French). — I propose to read the summaries one by one, and then to invite discussion on them.

Mr. Desprets, *Principal Secretary* (in French). — We will now consider the summary of Mr. Driessen's special report, and read and discuss the various articles in order.

Mr. Driessen (in French). — Article 1 is worded as follows :

The track work which is usually done with special tools (apart from the use of small tools like jacks, poneycars, etc.) are :

a) Unloading the ballast by means of special wagons;

b) Tamping the ballast by means of pneumatic or electric tampers;

c) Cleaning the ballast by chemical means.

Has anyone any remarks to make ?

Mr. Ruffieux, Paris, Lyons & Mediterranean Ry. (in French). — I propose that the word « cleaning » be replaced by the word « weeding ».

Mr. Quinquet, Paris, Lyons & Mediterranean, Ry. (in French). — I should like to give some information to the Section about the mechanical packer.

For some considerable time, the Paris, Lyons & Mediterranean Railway has made use of mechanical appliances driven by internal combustion engines (Collet type) for the packing of sleepers and for the tightening of fastenings.

Since last year this Company has also used the Christiansen appliances, supplied by the firm of Krupp.

Thus we are enabled to draw comparisons between these various types of appliances, based on the one hand on our own statistics and on the other hand on the statistics of the Reichsbahn (operating results for the year 1926) and on the particulars supplied by other systems.

The Christiansen appliances have the advantage of not encumbering the tracks and of being able to be kept in place during the passage of trains; but this advantage is procured at the expense of many disadvantages.

The cost price is 23 000 francs for two packing machines, whilst that of the Collet appliances is 60 000 francs for eight packers acting simultaneously.

515 Christiansen machines with twin packers have packed 2 647 km. (1 645 miles) in 100 days, the output per machine averaging rather more than 51 m. (167 1/2 feet) daily, packing on one side.

The Collet appliances do 150 m. (492 feet) daily packing on both sides.

With a Christiansen tool a man does 9 m. (29 ft. 6 in.) per day, packing a single side; and with a Collet 10 m. (32 ft. 9 in.) packing on both sides plus the tightening up.

The Christiansen consumes 20.16 kgr. say 30 litres (6.6 British gallons) of petrol per day; the Collet machine only 24 litres (5.28 British gallons) with eight packers and one tightening tool.

The maintenance of the Christiansen for 2 647 km. (1 645 miles) has cost 260 000 Rm., say 0.10 Rm. or 0.60 fr. per metre (0.0328 Rm. or 0.1968 fr. per foot), whilst that of the Collet appliance amounts to 0.30 fr. (0.0984 fr. per foot).

The Christiansen appliance is so readily damaged that according to the Swiss Railways, it is necessary to supply six

appliances to have four at work on account of the amount of repairs required annually; they state also that it is not desirable to use these appliances in hot weather on account of the misfires which occur.

The consumption of petrol per sleeper packed on both sides was 0.13 litre (0.0286 Br. gallon) with a Christiansen machine, and 0.04 litre (0.0088 Br. gallon) only with a Collet, including tightening up. The heavy fuel consumption of the Christiansen is due to wear of the parts; in order to obtain an idea of the magnitude of this wear we continued to use a machine of this type for eight months without repairs; the consumption of petrol at the end of this period amounted to 1 litre (0.22 Br. gallon).

We were persuaded to try the effect of packing one side only with the Christiansen. This kind of packing proved to be quite inadequate; the ballast when packed on one side was not compacted enough on the other side; and we were forced to use the Christiansen for packing both sides. This result is the same as that obtained by the French Nord Railway, which informed us from the tests they made of packing one side only by means of the Christiansen machine, that the packing carried out to refusal on one side of the sleeper, allowed the ballast to be much compressed on the other side, without making it move from the side first packed and that, in consequence, they decided it was necessary to pack both sides.

Finally with the Collet appliance, the packer rests on the rail so that its whole weight does not have to be carried by the workman, whilst with the Christiansen, the workman is obliged to support the whole of it. Moreover, those of our workmen who have used the two machines strongly insist upon being given the Collet machine only.

All these considerations definitely lead us to prefer the latter appliance, which in spite of the necessity for removing it to a safe distance, is more economical than the Christiansen appliance.

We have retained the latter machine only for lines having four or six tracks, where the removal of the Collet machine to let trains pass necessitates a somewhat lengthy journey when the central tracks are concerned.

The President. — In the text or article 1, there is a term in the English wording which does not correspond to the French term. It was proposed a moment ago to substitute the word « weeding » of the ballast for the word « cleaning » of the ballast.

If everyone agrees, we can pass to the next article of the summary.

Summary No. 1 is adopted with « weeding » instead of « cleaning » at *c*).

Mr. Driessen (in French). — Article 2 is as follows :

Track work for which mechanical tools deserve to be considered are :

a) Unloading of rails;

b) Rolling of ballast;

c) Laying of complete sections of track;

d) Oiling the running side of rails in curves.

Mr. Müller, *Reporter* (in German). — I propose to substitute in paragraph *b*) the term « artificial compression » of the ballast for the term « rolling ».

Mr. Desprets (in French). — Has anyone remarks to make on the adoption of article 2 ?

Mr. Ruffieux (in French). — I propose to add « driving coach-screws and screwing up fishplate bolts ».

Mr. Desprets (in French). — It is then a question of adding a paragraph *e*) to include : « driving coach-screws and screwing up fishplate bolts ».

Mr. Driessen (in French). — Gentlemen, so far as Mr. Müller's proposition is concerned, I should like to point out that in the reports I have found no means of consolidating the ballast except by rolling it in; it is the only method known of so far.

I am not opposed to the expression « artificial compression », but I have not put it in the summary because so far as my knowledge goes any other method than rolling in is hardly known so far.

As to Mr. Ruffieux's proposition, I should like to say that in my opinion, the driving of coach-screws and screwing up of the bolts is done by mechanical means, but it is not certain that these are economical. I have failed to find in the reports such a unanimity of ideas that one can say that this work can be mechanised and can be considered.

Mr. Müller (in German). — I would point out that in Germany we have, in addition to rolling in, another method of artificial compression, namely, by using wagon buffers. When for instance it is a question of relaying a branch and compressing the ballast or when trains follow one another at such close intervals on the line that not more than one to two-and-a-half hours are available, use cannot be made of a roller. In these cases, we utilise the other kind of artificial compression that is by means of wagon buffers. We make use of many thousands of these buffers. We also possess a little machine for this purpose (a beam with projections) which has, however, not yet been sufficiently tried out.

So far as the coach-screw machines and those for screwing up fishplate bolts are concerned, I am strongly of the opinion that their use for these purposes is essentially economical and practical. I am frankly partisan of the use of mechanical plant for these operations.

Mr. Quinquet (in French). — Mr. Driessen has just alluded to the difficulty he has had in drawing up the summary on the mechanical driving of coach-screws and mechanical screwing up of bolts.

I recognise here that it is our fault if Mr. Driessen has not been able to give a sufficiently precise summary.

I can say nothing about the bolts; I have not used mechanical tightening for bolts but only for coach-screws. It is enough to see the mechanical and hand driving of coach-screws to realise that the advantage of the former is very great, as it drives the coach-screw home very rapidly. With hand driving, as soon as the coach-screw begins to bite firmly into the wood, the resistance increasing very rapidly, it is often necessary to use two men to complete the driving, they having to put all their weight on the spanner and have difficulty in completing their task, even after a relatively long period.

With mechanical screw driving, immediately the socket of the appliance engages, the coach-screw goes home at once; it is therefore a considerable saving.

The cost ought not to be great; an electric motor is used. I cannot quote the exact figure, but it is clear when these two methods are seen together, that the mechanical system is infinitely quicker and less costly than the other.

Mr. Müller (in German). — I will confirm Mr. Quinquet's remark. We likewise have formed the same opinion as to the fishplate bolts, but to a less degree when dealing with coach-screws. But here again the use of machines is preferable.

Mr. Lemaire, Belgian National Ry. Co. (in French). — Several years experience on the Belgian National Railways have likewise confirmed the advantage of mechanical appliances for driving coach-screws; I have no figures at hand but opinion is distinctly in favour of the use of the appliances.

I am also of the opinion that it would be well to include mention of the coach-screw driving.

I should also like to see in paragraph *a*) the phrase « the unloading of rails » completed by « and the loading up of the old material ».

It is not only interesting to have mechanical appliances for unloading rails, or other material taken from the track, but also to use other machines such as motor trolleys, etc.

We might then complete the summary by saying : « The unloading of rails and the loading up of the material. »

Mr. Driessen (in French). — Gentlemen, I should like to make a few brief remarks.

As to what Mr. Quinquet has proposed to insert in the summary with reference to driving coach-screws, and as to fastening fishplate bolts, I do not think these tools are in universal use. Mr. Müller has already remarked that the benefit is not so great with the fishplate bolts as when driving coach-screws; in my opinion the coach-screws can only be driven advantageously under certain conditions; in any case, when it is a question of tightening up only a small number of coach-screws I think it can best be done by hand; but I do not wish to oppose the clause being added to the summary, as I see that the general consensus of opinion is that these operations can well be performed mechanically, but I would like, however, that the tightening up of fishplate bolts should not be introduced into the summary.

So far as the proposition of Mr. Lemaire is concerned, to add to paragraph *a*) the words: « and the loading up of the material », I must oppose because I do not see how the loading could be carried out otherwise than with cranes which on the railway involves the great drawback of the occupation of one or two tracks. It appears to me then that the loading up of the material should usually be performed by ordinary methods, that is to say without machines.

Mr. Lemaire (in French). — That is not what we do. We load rails perfectly well by two methods; we put them on trolleys and we push them on to a loading gantry or haul them up an inclined plane: we load direct on trucks, with no or little man-handling.

Mr. Driessen (in French). — That is not what is contemplated in the report, which has to do with works carried out on the permanent way; what you do are depot operations.

Mr. Lemaire (in French). — It is as interesting to have mechanical appliances to load as well as to unload new material. The complete renewal involves the bringing up of new material, the replacement of old by new, and the removal of the old material; it is necessary to consider the whole process otherwise the operation is incomplete.

Mr. Driessen (in French). — The President has proposed to change the expression « the rolling in of the ballast » and to add; « the rolling in of the ballast under the sleepers » which is to say the ballast below the bottom surface of the sleepers; this is, of course, understood, but it is as well to make the amendment. Thus « artificial compression of ballast under the sleepers ».

Mr. Ruffieux (in French). — In speaking of the fastening of the fishplate bolts, my intention was not to contend that it is at present economical, because on our system we have no experience of this kind of work, but it appears to us very desirable that it should be done, and my intention was to say « It would be desirable that a mechanical tool should be used for fastening fishplate bolts », « desirable » meaning here in my sense « worthy of consideration ».

I believe that it would be very interesting to insert it; for example a short paragraph might be added which would not be under the same heading as the words « worthy of consideration » but which would say « it would be equally interesting » or « it would appear to be equally interesting » to tighten up the fishplate bolts mechanically.

Mr. Driessen (in French). — I have enumerated in the summary only those operations which in my opinion could show economies, and I am by no means convinced that the fastening of fishplate bolts would; it is for this reason that I have omitted it.

Mr. Ruffieux (in French). — It is with this object that I propose to alter the wording; I had interpreted « equally worthy of consideration » in the sense « it would be equally interesting ».

I propose then not to change the existing text but to put another phrase at the end as follows : « it would be equally interesting to... », which has another sense.

Mr. Müller (in German). — I support Mr. Lemaire's remarks and propose to say : « the loading and unloading of rails and other permanent way material ».

Mr. Desprets (in French). — In order to close this discussion on article 2, here are the points on which we ought to have the opinion of the Section : paragraph *a*) — unloading rails and re-loading rails and other permanent way material. For paragraph *b*) — the mechanical compression of the bottom ballast.

We would then add a paragraph *e*) : — Driving of coach-screws and possibly tightening fishplate bolt nuts, mechanically.

— These two additions are adopted by the Section.

Mr. Driessen. — We will proceed to article 3.

Apart from cranes which are usually driven by a steam engine we find that both pneumatic and electric machines will meet all needs.

Mr. Müller (in German). — We use only cranes driven by Diesel or benzol motors; we consider them preferable because they are always ready for use. I should like to see the article amended in consequence.

Mr. Driessen (in French). — I agree.

— Adopted with the proposed addition.

Mr. Driessen. — Here is article 4.

The economic advantages are in several cases very appreciable and show savings of as much as 50 %. In order to get a good output from the machines, it is necessary to regulate strictly their use by drawing up a programme of work.

— Adopted.

Mr. Driessen. — Article 5 :

Apart from economy, the use of machines can lead to other advantages such as better work, less fatigue for the workmen, work carried out in shorter time, and the possibility of making up for a shortage of labour.

Mr. Mendizabal, *Reporter* (in French). — I agree to the adoption of article 5 but propose the addition of another summary to the effect : « Taking into account the short experience in the use of mechanical plant for the maintenance of the track, the administrations are recommended to tabulate, with all possible, care, comparative statistics which could provide proved and definite data. »

Mr. Desprets (in French). — The supplementary article proposed by Mr. Mendizabal would therefore read as follows :

Articles 5 bis :

« In view of the little experience of mechanical appliances in permanent way maintenance work, the administrations should be advisid to prepare with every care tables of comparative statistics from which clear and definite data can be obtained. »

Mr. Driessen (in French). — I should like to point out that Mr. Mendizabal's proposition is correct, but it does not seem to me to be very necessary to enunciate it.

We have said that there are certain operations which are already performed mechanically, and others deserving to be so done, but I scarcely think that this summary 5 (*b*) states anything further. It is added here « Comparative statistics should be tabulated ». It goes without saying that it is necessary to proceed in this manner, if it is desired to introduce a new appliance, in order to ascertain whether it will be economical or otherwise.

It seems to me unnecessary to enunciate this obvious truth.

Mr. Desprets (in French). — We propose to put article 5, as drawn up, to the vote.

Mr. Müller (in German). — The wording of this article is too long in German.

Mr. Desprets (in French). — Let us vote first of all on article 5 as drawn up, apart from Mr. Mendizabal's addition.

— Adopted.

Article 5 *b*) as edited by Mr. Mendizabal :

— Article 5 *b*) is rejected.

Mr. Driessen. — Article 6 :

Gangs or brigades entrusted with the maintenance of the track are nearly everywhere uniformly distributed along the lines. The use of flying gangs for special work, such as the renewal of the track, might be taken into consideration; it is important to entrust the the gang with all work connected with maintenance of the track, in view of its responsibility for the good condition of the track, and for the safe passage of the trains.

Mr. Ponticelli, Italian State Rys. (in French). — I propose to omit the second part of this article. For some years, on many districts, we have put out the general maintenance to contract, with very good results.

In recent years we have even put out to contract, on several sections of the track and stations, all the maintenance work normally executed by the regular gangs, and this practice also gives us satisfaction both from the technical and economic points of view.

Mr. Desprets (in French). — The text will then be limited to the first paragraph as follows : « Gangs or brigades entrusted with the maintenance of the track are nearly everywhere uniformly distributed along the lines ». Such is the proposition.

Mr. Lemaire (in French). — I should like to point out that if the second part is withdrawn, the first disappears also.

Mr. Müller (in German). — I ask for the retention of the second phrase. In principle, we do not have recourse to private enterprise for the maintenance of the track. We only let works to contract for the renewal and construction of the tracks, because it is difficult to fix the price; it is impossible to decide beforehand what has to be done on the track. We contend that maintenance work on the permanent way cannot be estimated.

In the first phrase of the article I ask for the word « uniformly » to be dropped. This distribution does not exist with us. We concentrate gangs at points where work of general maintenance has to be carried out.

Mr. Quinquet (in French). — Without asking for the total suppression of the end of the article, I should like amendments made to the terms used.

There appears : « It is important to entrust the gang with all work connected with the maintenance of the track... » This is desirable, it is understood, but we cannot do it at this moment on the French systems, on account of shortage of personnel; we are forced to have recourse to private enterprise whilst recognising that this should be done to the least possible extent. For works of general maintenance we have contracts which permit us to place the maintenance of way during a certain number of months in the charge of contractors.

The term « it is important » is rather too absolute.

Mr. Driessen (in French). — Gentlemen, I think we should first decide on the proposal to drop the word « uniformly »; if we leave what remains « Gangs entrusted with the maintenance of the track are nearly everywhere distributed along the lines... » Mr. Müller's proposition does not seem acceptable. But there is another point; the word « uniformly » evidently does not mean to say that on every kilometre of the line there is the same number of men. Anyone who has read the special report will understand quite well that « uniformly » means to say « uniformly according to the work to be done ». If it is desired to add a few explanatory words, I do not object, one might even put : « almost uniformly in view of the work to be done » or another equivalent phrasing. In my opinion, that is not necessary, « uniformly » naturally means to say uniformly according to the work to be done.

Mr. Quinquet (in French). — Or « distributed according to requirements ».

Mr. Driessen (in French). — « Following requirements ».

Mr. Lemaire (in French). — I am of the opinion that it would be better to omit the whole, for it does not mean very much. On the subject of the term « uniformly », I would point out that in Mr. Mendizabal's report it is stated :

QUESTION 5. — Do you use formulæ (or tables) to determine the number of men required for the maintenance of a certain length of road (single track or several tracks)? If so, what are these formulæ ?

The Belgian National Railways use formulæ and they give complete satisfaction; contrary to what Mr. Mendizabal has said, they are not complicated.

The strength of our gangs is by no means uniform; it is constituted according to formulæ, and following various factors relating to the line. Hence « uniformly » is not correct so far as we are concerned.

As to the second phrase : « The use of flying gangs for special work such as the renewal of the track might be taken into consideration », I should like to ask what else could be done if flying gangs were not organised to carry out the other works. It is a necessity to have special gangs for that. « Might be taken into consideration » should be replaced by « necessary », whether it be contract or departmental work.

Finally, the third phrase : « It is important to entrust » is also an obvious truth, and, in truth, it is not particularly relevant to the object of question IV : Improvements, Organisation.

Mr. Ruffieux (in French). — I support Mr. Lemaire's proposition, especially as I think I remember that in London this question was also discussed, and summaries drawn up which were unanimously adopted on this matter.

Mr. Tettelin, French Nord Railway (in French). — I support the proposition just made and I should like to make a general remark which might be useful. We are discussing the question of mechanical plant. We notice that such plant for present day maintenance exists — I stress this question — I do not refer to track renewals which are much greater and non-periodic undertakings.

The mere existence of mechanical plant, from the fact that decision is made to use it, requires an organisation of the labour which is going to use it, an organisation totally different from that set up when there was no mechanical equipment. When speaking of the regular distribution of personnel along the line, one is under the domination of a state of affairs which did not include mechanical plant.

There were then, along the line, gangs of five or six men, having hand tools, with which, from one end of the year to the other, they strove to maintain the track in good condition. But if it is decided to put the mechanical tools into use, tamping machines, coach-screw driving machines, it is not five men who are going to use them; it requires, in order to justify them, a special equipment which will travel from one end to the other of the line and which in its campaign will do 80 to 100 km. (50 to 62 miles) of complete track maintenance.

This maintenance of the tracks with flat-bottomed rails — I have this kind in view — fixed by coach-screws and not by spikes, consists essentially of ensuring the constant tightening of the fastenings. The coach-screws must firmly hold the rails, so that there is no play between the rails and the sleepers; the sleepers

must rest solidly on the ballast to avoid any dancing sleepers; that is the object of regular maintenance; the tamping and coach-screwing machines are perfectly suitable for these purposes.

When the work has been done from one end to the other of the line, the latter can be let alone for a certain period during which there is no necessity for any labour.

One can then imagine an organisation in which the workshop with the tamping and the coach-screwing machines would travel along each section of the line at intervals shown by experience to be suitable. As to the permanent personnel of the line, it will be greatly reduced, because there will scarcely be any need to concern oneself with the track between two visits of the mechanical equipment; consequently, on the understanding that we are discussing here the question of mechanical plant, we must carefully abstain, seeing we are just beginning to use it, from making rules prescribing the manner of its use, or from confusing this use of new equipment with old methods not including mechanical appliances.

In consequence, I support the proposition of Mr. Lemaire and I will ask also for the withdrawal of several future summaries which question the methods, that is to say the use of manual labour according to a method which is old if there is no mechanical plant, or new if there is such; the employment of labour cannot be the same in the two cases.

Therefore, I think that the Section, can ignore, for the moment, the manner in which manual labour will utilise mechanical tools, and leave to a future Congress the duty of investigating whether this manner is good or bad.

Today it is on mechanical plant only that we ought to give our opinion.

Mr. Driessen (in French). — Gentlemen, I am very happy to have added to article 6 the end of this paragraph, because it has occasioned a very interesting discussion. We have seen that there are two totally opposite ways of looking at the question.

In my opinion, Mr. Tettelin proposes to say : Owing to the mechanical plant, it is necessary that works, so far as possible, should be carried out by... let us say a « large gang ».

Mr. Tettelin (in French). — Twelve to fifteen men.

Mr. Driessen (in French). — Large gangs having to maintain a big part of the track.

Mr. Tettelin (in French). — Twelve to fifteen men constitute in this case the ordinary gang.

They do 80 to 100 km. (50 to 62 miles) of track during a good season. It is a mobile gang for the mechanical equipment.

Mr. Driessen. — That is difficult for special work.

Mr. Tettelin. — It is intended only for the regular maintenance of the track.

Mr. Driessen. — And the small gang?

Mr. Tettelin. — There is no longer any reason for its existence; when the gang with the mechanical equipment has carried out its duties only work other than that in connection with the main line remains to be done and to be ready for the unexpected; it is very little. A very reduced local staff is then all that is required.

Mr. Driessen. — We can, therefore,

take it that Mr. Tettelin would have a gang which would carry out the principal maintenance on a length of 80 to 100 km. (50 to 62 miles).

But he has not mentioned a matter which, in my opinion, is most important, that of responsibility. Who is responsibile for the proper upkeep of the track? The mobile gang ensures the important upkeep of the track.

Mr. Tettelin. — All the maintenance.

Mr. Driessen. — Except day-to-day maintenance.

Mr. Tettelin. — No more day-to-day maintenance remains to be done.

Mr. Driessen. — This gang is then responsible for the daily maintenance of the 80 km. (50 miles) which seems to me quite impossible, there may be broken rails, or sleepers...

Mr. Tettelin. — It is the personnel (very reduced) having charge of the line which attends to service mishaps and broken rails (which seldom occur).

Mr. Driessen. — Then the placing of responsibility is difficult.

Mr. Tettelin. — Above this local staff there is the district inspector, the section inspector and the engineer, who have all their share of responsibility.

Mr. Driessen. — The responsibility is then divided between two inspectors, and that seems to me to be a procedure which is not admissible. That is why I put into the summary : « It is important to entrust the gang with all work connected with the maintenance of the track. »

Mr. Quinquet is entirely in agreement; he has moreover proposed to change the words « it is important » to « it is desirable ».

There are two quite opposite points of view.

Mr. Tettelin. — When the renewal of a track has been carried out by contract, the responsibility of the contractor ceases when his work is complete and passed; the work of my gang may be looked upon as a small contract for putting the track in order, which work is checked and when finished it is the local officials who take over the responsibility, just as in the case of work let to contract, after the departure of the contractor.

Mr. Driessen. — That is the reason why I am not in favour of maintenance by contract. As a general rule I believe it to be very important that all renewals should be executed, as far as possible, by the permanent staff of the railway.

Mr. Tettelin. — This is materially impossible.

Mr. Driessen. — It is nevertheless of importance that the staff should itself attend to all the maintenance.

A delegate (in French). — The staff should collaborate.

The President. — I propose to vote on article 6 as it is worded, the words : « it is desirable to entrust the gang with all work » being, however, substituted for : « it is important to entrust the gang... »

Mr. Lemaire (in French). — Ought we not to vote on the deletion pure and simple ?

Mr. Desprets (in French). — We will vote on the question of whether we retain

the article whilst only replacing « it is important » by « it is desirable ».

Article 6 is eliminated.

Mr. Driessen (in French). — We will proceed to article 7.

In the organization for maintaining the track, several innovations have been introduced, having for their object a more economical maintenance. The chief innovations are : the introduction of maintenance by general revision; reducing the strength of the gangs in winter; increasing the area covered by the gang by the employment of auto-cars for transporting men and materials.

Mr. Quinquet (in French). — In the text as proposed to the Section there appears : « The chief innovations are : the introduction of maintenance by general revision. »

We have done this for at least 35 years on the Paris, Lyons & Mediterranean Railway.

An innovation, however, is the introduction of mechanical tools, and also shovel tamping.

Mr. Driessen (in French). — It is perhaps fair to reply at first to these two questions.

Mr. Quinquet has said that maintenance by general revision is not an innovation, and this is very well known; the Dutch railways have done it for twenty five years, but there are other Companies who do not carry out general revision, and I must remark that for *these* Companies it is an innovation; it is for that reason that I have included it amongst the innovations. I think that is quite fair.

Mr. Quinquet (in French). — So long as there remains a Company which does not do it, it would still be an innovation!

Mr. Driessen (in French). — For the Company which introduces it, it is an innovation. Mr. Quinquet also remarks that shovel packing is not very widespread; it is not yet certain that this is a really good method of maintenance under all conditions and that one can say that shovel packing ought to be introduced.

Mr. Quinquet. — Shovel packing is an innovation which is not very new; it was employed by the « London & North Western Railway » twenty five years ago; it was there that it originated. It is really an innovation on the Continent.

Mr. Driessen. — Several Companies adopt shovel packing, but they are not numerous.

Mr. Quinquet. — Yes ! In France.

Mr. Driessen. — It is not mentioned here, because the article deals with the organisation of the maintenance and not with mechanical maintenance.

Mr Quinquet. — The introduction of automobile trolleys is also spoken of, and that is certainly mechanical.

Mr. Müller (in German). — I would point out that, « maintenance by general revision » is a method which, whilst being already in application on such and such a system, constitutes nevertheless an innovation. I propose that the paragraph be adopted.

Mr. Quinquet. — « The extension » might be put instead of « the introduction ».

The President. — Let us vote on article 7, the words : « the introduction of

maintenance by general revision » being replaced by « the extension of maintenance by general revision ». The question of mechanical equipment would, on the other hand, be added at the end of the article which would thus terminate as follows : « ...; the employment of autocars for transporting men, stores and mechanical tool equipment ».

Article 6 (formerly No. 7) thus amended, is adopted.

Mr. Driessen. — Article 8 :

The length of the road to be maintained by a brigade and the strength of the brigades differ within wide limits. The only rational basis for determining the number of men required for maintenance is the length of equivalent track, which is to be calculated by means of formulæ. It is necessary to introduce into these formulæ all the factors bearing on the maintenance, giving them their appropriate coefficients.

Mr. Müller (in German). — I consider this a rational wording and will remark that in Germany we calculate the virtual lengths of the lines to determine the number of workmen and the days to be worked.

Mr. Tettelin (in French). — I am asking myself whether the General Meeting will be very enlightened when we submit for its approval a text which says that the length of track maintained by a gang and the strength of a gang vary within wide limits, or that in order to decide the strength, it is necessary to have recourse to formulæ introducing all the factors affecting it.

But having this text, we have no formulæ. Consequently, I think that we are stating a generalisation which is a little too wide to be worth the trouble of submitting to the General Meeting as the result of our deliberations.

Mr. Driessen (in French). — Mr. Tettelin has requested the suppression of the article. I would point out that at the reading of the detailed replies of the Companies, one is astonished at the great differences in the strength of the personnel available for maintenance work; there are Companies having ten men per kilometre, others have five and others which have only one per kilometre. I consider that it is simply because the Companies do not investigate the number of men necessary.

The first part of the article is not in truth a conclusion, it is a statement that the number of men allotted to the maintenance of a road varys within wide limits.

And in the second place, there are still many Companies who do not see the importance of the use of formulæ for calculating the strength of gangs, and others who employ formulæ of an extremely embryonic and limited nature, and so few conditions are accounted for in these formulæ that it is necessary to revise them, and hence I think it well to have reworded article 8 in its present form.

Mr. Zavadil, Ministry of Railways, Czechoslovakia (in French). — In Czechoslovakia, we have also very good results so far as the establishment of equalised kilometres is concerned, that is to say kilometres equivalent to a kilometre situated in normal conditions on a single track line of standard gauge, with curves of radii exceeding 1 000 m. (50 chains), but gradients of less than 5 in 1 000, the rails weighing more than 40 kgr. (80 lb. per linear foot), less than 10 years of age, sleepers of hard wood and ballast of broken stone.

But there are also additional factors, the speed of the trains and the number of trains travelling over the line daily. We have had very good experience and we recommend the retention of this article.

Mr. Quinquet (in French). — For the moment we are concerned with the rational organisation of the maintenance of way, but I think that the systems who have one man per kilometre consider themselves as rational as those who put twelve. I propose that the article should be withdrawn.

The President. — I propose to vote on the deletion of the article.

— Article 7 (formerly No. 8) is adopted.

Mr. Driessen. — The article formerly No. 9 :

Maintenance by general revision is to be recommended, not only as an economic measure, but also in order to have an effective control of the personnel entrusted with the maintenance of the road.

— Adopted as No. 8.

Mr. Driessen. — The article formerly No. 10 :

There are only a very few Administrations who have certain work carried out by their personnel by piece work, or who grant premiums for the execution of certain work within a fixed period. Nevertheless, this practice deserves attention, as much from the economic point of view as in the interest of the workmen, the fear that the quality of the work will suffer, not being justified.

— Adopted as No. 9.

Mr. Driessen. — The article formerly No. 11 :

The 8-hour day (48 hours per week) or a period which does not materially depart therefrom, is fairly general. Often in summer the day is longer, but in winter shorter, than the normal day.

— Adopted as No. 10.

Mr. Driessen. — The article formerly No. 12 :

Generally the working time begins to count from the moment when the workman arrives at the designated spot, either the gang depot or a station, or the place where the work has to be done.

— Adopted as No. 11.

Mr. Driessen. — The article formerly No. 13 :

The use of auto-cars to take men to their work is not very general, and is only indicated in cases where habitually the work is begun at a spot (depot, station) other than that where it should be normally.

Gentlemen, I notice that the text as drawn up is not exactly what I had put forward; I see that there is : « dans les cas où il est éloigné du siège habituel des travaux »; I mean to say by that the place where the workmen assemble to start work.

In English and in German the wording is correct, but in French it is not.

I propose to amend the ending and to put only : « dans les cas où il est éloigné de la place où ils se rassemblent pour commencer leur journée ».

Mr. Tettelin (in French). — It would be simpler to put « point de concentration ».

— Adopted as No. 12, embodying this amendment.

Mr. Driessen. — The article formerly No. 14.

For augmenting the life of the materials used, the following measures are to be recommended : the use of heavy rails, special steels (for instance sorbitic steel) for rails and points, hard wood for the sleepers, heavy base plates, broken hard stone for ballast, increasing the number of sleepers, lubricating the fish plates and the running side of the rails on curves, repairing worn parts.

Mr. Fowle, Great Indian Peninsula Railway. — I think the words in brackets « for instance sorbitic steel » should be omitted.

Mr. Desprets (in French). — Our colleague, Mr. Fowle, proposes to omit the words between brackets : « for instance, sorbitic steel ». He considers that we cannot recommend sorbitic steel in any definite manner.

This proposition coud be accepted.

Mr. Tettelin (in French). — If the use of heavy base plates is put forward as a means of increasing the life of the permanent way, I should like to make a communication to those of our colleagues who employ these with Vignole rails.

The metal base plate used in certain systems under the Vignole rail is a survival of the chair which is necessary under the bull-headed rail, but the Vignole rail has been designed with a shoe which permits the chair to be dispensed with.

The French Est & Nord Railway Companies have always used and still use the Vignole rail on wooden sleepers without base plate or metal seating and they find this very satisfactory.

Wear does not occur under the bottom flange of the rail as in the case of the roads with seatings, because the flange rests on the sleeper and wood does not wear into steel. Moreover, if care is taken to keep the coach-screws tight, there is no play between the rail and the sleeper and experience shews that the top surface of the sleeper scarcely wears at all. Last year I took up on the main line from Paris to Calais, a portion of the track having rails of 45 kgr. (90.7 lb.) per yard with sleepers 38 years old and still in good condition.

We have in service on the main heavy traffic lines, near Paris, some sleepers 42 years old, and I invite those of our colleagues who are interested to come and see them.

Therefore, according to the usual practice of the two aforementioned Systems — which have between them more than 16 000 km. (10 000 miles) of main lines — it is not necessary to use metal seatings under the Vignole rails resting on sleepers of hard wood, and as these seatings have certain disadvantages, it is worth while avoiding them as much as possible.

Mr. Driessen (in French). — Gentlemen, as far as the deletion of paragraph 14 is concerned, I would like to point out that I have not been nominated a reporter at the beginning. I found, on assuming my duties, a questionnaire in which were inserted questions relating to article 14; it is simply out of deference to my predecessors that I have put No. 14 in my summary; I could not then oppose the omission if the Meeting considers it better. As to Mr. Tettelin's statements on the subject of base plates, it seems to me that he has lost sight of the fact that there are certain forms of construction where these are in general good.

I agree with Mr. Tettelin when he says that a base plate is not a desirable unit for a track, certainly not for present day construction in general.

But a form of construction is in existence at the present time which is principally utilised on the German railway system where separate fastenings are used between the rail and the base plates and between the base plates and the sleepers.

It is a noteworthy improvement, this construction has been copied from the Dutch form where the arrangement is similar with cast iron chairs, but I do not wish to launch a discussion as to which is the better; I do not wish to be in disagreement with our German colleagues, but we are very satisfied with our cast iron chairs and the Germans with their plates.

Mr. Lemaire (in French). — On the Belgian National railway system which comprises about 5 000 km. (3 200 miles) of main lines, we work on the same lines; the base plate is omitted on hard wood sleepers in straight alignments and curves of large radius and we retain the plates for soft wood sleepers; in the latter case the method is similar to that of the Dutch system; a preliminary fastening in the yards of the plate with two coach-screws and two other coach-screws fix the rail on the plate on the job.

Mr. Driessen (in French). — We have a cast iron chair between the rail and the sleeper; it is a well defined and precise method.

Mr. Müller (in German). — So far as the question of seatings is concerned, I will say that we have 70 000 km. (43 500 miles) of track on wood sleepers and that our permanent way is designed to use soft wood sleepers with seatings. We have also made trials on a big scale with hard wood sleepers without seatings, but we distinctly prefer the seatings. I am in favour of this paragraph being retained.

Mr. Driessen (in French). — I should like to make another brief remark about what Mr. Müller has said on the subject of rail fastenings on hard wood. One can be in perfect agreement on this matter, it is necessary to have as few intermediate parts as possible, but there is one condition which should be fulfilled, which is, that the bottom flange of the rail should be wide enough, and therein always lies the great difficulty.

We have also the « Est » system as we term it, in use for rails with bottom flange of 110 mm. (4 11/32 inches) wide, and in reality this is not wide enough.

In Germany this kind is also employed, but 125 mm. (4 63/64 inches) wide; this is already the limit. The French rail has a width of 135 mm. (5 5/16 inches). If a rail of this size is used then the « Est » system can be adopted without difficulty.

I think the explanation, that one has good results with the « Est » system and another has not, lies in the variation of the width of the bottom flange.

Mr. Quinquet (in French). — I will allow myself an observation, perhaps peculiar to the Paris, Lyons & Mediterranean, on the subject of seatings.

We have unfortunately a large number of mountain railways of very irregular profile, containing curves of 250 m. (12 1/2 chains) radius at frequent intervals, and there we cannot dispense with the seatings. In fact, in curves of 250 m.

radius we find the gauge widened to a considerable extent.

We find the same thing on curves of 400 m. (20 chains). run over by modern locomotives of long wheel base.

We use a seating provided with lugs; the bottom flange of the rail, placed between these lugs, which project from the face of the seating, when subjected to a lateral thrust from the engine, presses against one of these lugs; the four coach-screws which pass through the seating thus all work to resist the widening of the gauge which the lateral thrusts tend to produce. This ribbed seating not ony distributes the pressure of the axles over the sleeper, in the same way as a flat plate, but also has the effect of resisting lateral forces.

I recognise moreover that the seating possesses disadvantages, above all in underground tracks, where comparatively great wear occurs between the surfaces in contact of the rail and seating; so that for the time being, we have abolished seatings on underground railways.

But we are searching for the means of avoiding this wear, arising from the rubbing of the steel surfaces in contact, by inserting between the flange and the seatings, various packing plates, either of indiarubber or of bakelised wood. We are still in the experimental stage and it is only when we have found an efficacious solution that we shall be able to reinstate seatings in the underground tracks.

The President. — Let us vote on the deletion of article 14.

— Article 14 is retained.

Mr. Marsh, Madras & Southern Mahratta Railway. — Article 14 being retained, I think it would be better to substitute, at the end of the summary, the word « replacing » for « repairing », as I am unable to see how worn parts can be repaired on the spot.

Mr. Tettelin (in French). — I propose that instead of « the following measures are to be recommended » we substitute « the following measures are applied », thus affirming a fact and not a doctrine.

Mr. Driessen (in French). — I agree with Mr. Tettelin. As to the proposition of our English colleague, I am not in agreement because the making good of the worn parts is another thing to the replacement of the worn parts. I wished to say expressly that it is the repair of worn parts taken from the track which is in question here, parts repaired and used again in the road. It is quite different from the replacement.

The President. — I propose to vote on the substitution of « the following measures are applied » for « the following measures are to be recommended ».

— Adopted.

The President. — I also propose to alter the concluding sentence to read : « and the running side of the rails on curves, repairing *and replacing* worn parts ».

Mr. Quinquet (in French). — That would be « using again » rather than « repairing ».

Mr. Desprets (in French). — That would then be « repairing worn parts and subsequently using them again ».

Has anyone any objection to put forward ?

— The article formerly No. 14 (now No. 13), amended accordingly, is adopted.

Mr. Driessen. — Article 15 of the proposed summary :

The use of graphs showing the progress of all works, with indications of the economic results obtained, is not very general. It is doubtful whether the heavy work which the preparation of such graphs demands is proportional to the advantages they give.

Mr. Zavadil (in French). — I will venture to make a few observations on the subject of the graphs which are used in Czechoslovakia on the principal railways. The graphs are shewn in appendix IV of Mr. Hauer's report. These graphs give information on the division of the works indicated and the percentage losses.

In order to prepare comparative graphs, it is necessary to consider the relative facts. That involves practically no increase of work for the staff concerned.

After three years use of the graphs in question, we have found that the average figures of the losses for the lines concerned vary little. That is why we have abandoned them this year.

If the variations of the losses are not great, that simplifies our diagram. The graphs are prepared in the office, the are instructive and serve as a basis for easy comparison with other graphs prepared in the same manner, and which shew us more clearly than the statistics themselves, the variations of economic results.

They are very useful for the analysis of costs of maintenance, for the study of the rationalisation of maintenance work of the permanent way and for the control service, and our administration considers that the use of the graphs referred to is advantageous.

But this opinion would, therefore, be in contradiction with the second sentence of article 15, and in contradiction with the summary of Mr. Driessen. In this connection I would recall that Mr. Hauer expresses himself as follows in No. 14 of the precis of his report :

« On this basis it will probably be possible to consider likewise the introduction of contract and bonus work for the permanent way maintenance. »

That is why it seems to me necessary to modify the second sentence or to omit the article.

Mr. Müller (in German). — I agree with what has been said. In Germany also, we attach a very great importance to it and we have obtained excellent results by controlling the district inspectors by means of this data. In our opinion, the expenses incurred in preparing the graphs are in quite a reasonable relationship to the economies which can be realised.

Mr. Lemaire (in French). — It is precisely in the sense or our Czechoslovakian and German colleagues that I woud like to demonstrate to you that in Belgium equally we prepare graphs, two varieties of graphs : firstly a general graph of the programme of works of the Company, and then a daily graph.

The manner of proceeding is very simple; the office of the technical permanent way inspector receives daily the work sheet of the yard foreman, and immediately the results of the maintenance are plotted on sheets of tracing paper ruled in square milimetres, fastened to the walls of his office. A few operations on a calculating machine give at once the output of the day, of the week and of the whole of the organisation. When we observe an interesting feature we pass it on to the sectional foremen with appropriate comments.

The cost of preparing these graphs is not great, contrary to what is said in the second sentence of article 15.

I believe it does not exceed 1 in 1 000 : for an expenditure of 1 000 000 francs, the cost of the graphs would be of the order of 1 000 francs inclusive, which is a small matter.

The experience of several years has shewn us that the result was very interesting. Moreover, as all the graphs are assembled on the walls of the office of the technical inspector; from time to time, at the general meetings of the district or sectional foremen, the latter are admitted into the office of the technical inspector where they are shewn the various graphs, the weak features of the output of their gangs, the interesting results of such and such a gang, and the methods of organisation. All that engenders a real emulation amongst the staff of all grades.

We then search together for the reasons of these results, favourable or otherwise, and from this point of view the graphs which, at a few glances, sum up for you the comprehensive results of working, are of lively interest.

It is evident that the use of these graphs is not widespread, but they are highly recommendable.

We could then anticipate a sentence somewhat in the form of : « They are little used but we recommend them. »

Mr. Driessen (in French). — The delegates who have spoken in favour of the preparation of graphs have forgotten one thing; it is that we are here concerned with the costs of the different works. We are all in agreement that attention should be paid to the cost of works, but it is a question of the preparation of graphs such as those appearing in Mr. Hauer's report, graphs of such extent that they do not justify the great cost they involve, and not only that, but I am of the opinion that a foreman who must enter for each workman what work he is doing at every moment, will not look at their work; he will spend all his time taking notes.

In the summary of the special report, I wanted to say that graphical representation of all the works such as appears in Mr. Hauer's report, does not justify the expense and the trouble which is given in preparing them.

Mr. Tettelin (in French). — It is then a matter of detailed graphs of the whole of the works? There is confusion with the technical graphs of which Mr. Lemaire has spoken.

Mr. Lemaire (in French). — Yes, evidently, the whole of the works is not concerned.

The President. — I think we are all in agreement with regard to the first sentence of article 15 reading : « The use of graphs showing the progress of all works, with indications of the economic results obtained, is not very general. »

— It was agreed to delete the sentence beginning, « It is doubtful ».

The President. — I also propose to vote on an addition worded as follows : « These graphs should be used on a larger scale » or « These graphs should be used increasingly ».

Mr. Driessen (in Frensch). — I should like to remark that we could complete the amendment in these terms : « but they should be of the simplest possible form »; that will put everybody in agreement.

Mr. Desprets (in French). — Every-

body will agree to word the paragraph as proposed but with the amendment suggested by Mr. Driessen.

— Adopted.

Mr. Driessen. — Article 16 of the proposed summary :

The general custom of recruiting the gang foremen from the platelayers, and of giving them an exclusively practical education, gives satisfaction.

Mr. Tettelin. — Is it not permissible to consider this paragraph as being irrelevant to the matter dealt with? It is a question of staff; a vote might be taken on the deletion of paragraphs 16 and 17 as not coming within the purview of the question.

Mr. Desprets. — I am first going to read paragraph 17 :

In general, an average standard of education is required of district foremen, who must pass through a probationary period which may, or may not, include regular classes before definite appointment.

Mr. Driessen (in French). — I wish to make a remark on what Mr. Tettelin has said : Before being appointed reporter I found a question already put forward, and this being the case, I wished to give a summary.

I am not opposed to the deletion of this article.

Articles 16 and 17 of the proposed summary are deleted.

Mr. Desprets (in French). — Gentlemen, I must remind you that we should now decide on the questions proposed for the 1933 Session. I would advise the Section that the complete wording of the question has been prepared by the Permanent Commission of the Congress, which consists of the representatives of all the Railway Companies.

We cannot change either the nature or the wording of the questions.

The following are the questions proposed :

I. — The protection of level crossings in view of modern developments in road traffic.

II. — The use of mechanical appliances in permanent way maintenance and in track relaying.

III. — The welding of rails in general. Equipment used for the purpose. Expansion.

IV. — The relationship between the vehicle and the track, to ensure safety at high speeds :

a) Weights of vehicles per axle, position of the centre of gravity, wheel arrangement, layout to facilitate running through curves;

b) Track resistance. Widening of gauge. Radius of curves. Superelevation. Transition curves. Points and crossings. Check rails.

If you have no objection, we will proceed to the vote according to the procedure indicated by Mr. Levy, that is to say we will first of all vote against the questions according as they appear and the question which receives the greatest number of *adverse* votes will be put aside. There is no other possible method without becoming involved in interminable discussions which would lead nowhere.

I propose then that we take the vote on the first question.

— The first question is adopted.

Second question.

— The second question is adopted.

Third question.

— The third question is rejected.

Fourth question.

— The fourth question is adopted.

The President. — The questions to be placed on the agenda for the next Session are thus I, II and IV.

Before declaring the work of the Section completed, I wish to express my appreciation of the patient manner in which you have borne my chairmanship, considering that I have not been able to closely follow the discussion in languages other than English. I also feel I am voicing your feelings when I express thanks to the Secretaries who have so ably translated the various remarks in the discussions, as well as to the stenographers who have been able to get down a correct record of the proceedings in such difficult circumstances. I am also grateful to Mr. Desprets for the very able manner in which he has supported me throughout. (*Applause.*)

DISCUSSION AT THE GENERAL MEETING.

Meeting of the 14 Mai 1930 (morning).

PRESIDENT : MR. JOSÉ GAYTAN DE AYALA.

GENERAL SECRETARIES : MESSRS. P. GHILAIN AND A. KRAHE.

ASSISTANT GENERAL SECRETARIES : SIR HENRY FOWLER, K. B. E., MESSRS. P. WOLF AND J. M. GARCIA-LOMAS.

Mr. Ghilain, *General Secretary.* — The summary relating to Question IV, as adopted by the 1st Section, has been published in the *Daily Journal of the Session* and, therefore, I think it is unnecessary to read it here. Are there any objections to this summary ?

— No objections.

The President. — The summary is as follows :

SUMMARY.

« 1. The track work which is usually « done with special equipment (apart « from the use of small tools like jacks, « poneycars, etc.) is :

« *a*) Unloading the ballast by means « of special wagons;

« *b*) Tamping the ballast by means of « pneumatic or electric tampers;

« *c*) Weeding the ballast by chemical « means.

« 2. Track work for which mechanical « tools deserve to be considered is :

« *a*) Unloading rails and re-loading « rails and permanent way material;

« *b*) The mechanical compression of « the bottom ballast;

« *c*) Laying of complete sections of « track;

« *d*) Oiling the running side of rails « on curves;

« *e*) Driving coach screws and possi- « bly tightening fish-plate bolt nuts, me- « chanically.

« 3. Apart from cranes which are « usually driven by a steam engine or « Diesel or internal combustion motor, « both pneumatic and electric machines « meet all needs.

« 4. The economic advantages are in « several cases very appreciable and « show savings of as much as 50 %. In « order to get a satisfactory output from « the machines, it is necessary to regu- « late strictly their use by drawing up « a programme of work.

« 5. Apart from economy, the use of « machines can lead to other advantages « such as better work, less fatigue for « the workmen, work carried out in « shorter time, and the possibility of « making up for a shortage of labour.

« 6. In the organisation for maintaining the track, several innovations have been introduced with a view to economy. The chief innovations are : the extension of maintenance by general revision; reducing the strength of the gangs in winter; increasing the area covered by the gangs; the employment of auto-cars for transporting men, stores, and mechanical tool equipment.

« 7. The length of the road to be maintained by a brigade and the strength of the brigades differ within wide limits.

« A rational basis for determining the number of men required for maintenance is the length of equivalent track, which is to be calculated by means of formulæ. It is necessary to introduce into these fomulæ all the factors bearing on the maintenance, giving them their appropriate coefficients.

« 8. Maintenance by general revision is to be recommended, not only as an economic measure, but also in order to have an effective control of the personnel entrusted with the maintenance of the road.

« 9. There are only a very few Administrations who have certain work carried out by their personnel by piece work, or who grant premiums for the execution of certain work within a fixed period. Nevertheless, this practice deserves attention, as much from the economic point of view as in the interest of the workmen, the fear that the quality of the work will suffer, not being justified.

« 10. The 8-hour day (48 hours per week), or a period which does not materially depart therefrom is fairly general. Often in summer the day is longer, but in winter shorter, than the normal day.

« 11. Generally the working time begins to count from the moment when the workman arrives at the designated spot, either the gang depot or a station or the place where the work has to be done.

« 12. The use of auto-cars to take men to their work is not very general, and is only indicated where work is started habitually at a place other than at which the men are concentrated.

« 13. In order to increase the life of the materials used, the following measures should be adopted : heavy rails, special steels for rails and points, hard wood sleepers, heavy base plates, broken hard stone for ballast, increasing the number of sleepers, lubricating the fish-plates and the running side of the rails on curves, repairing worn parts and subsequently using them again.

« 14. The use of graphs shewing the progress of all works, with the indication of the economic results obtained is not very general. These graphs should be used increasingly but they should be of the simplest possible form. »

— The General Meeting ratified this summary.

[625 .172 (.44)]

Permanent way weeding by chemical methods on the Paris, Lyons and Mediterranean Railway,

by Mr. QUINQUET,

Chief Engineer, Headquarters, Permanent Way Department of the Paris, Lyons and Mediterranean Railway.

Figs. 1 to 4, p. 2281 and 2282.

The trials of weeding the track by chemical solutions which we have carried out methodically for several years have led to very conclusive results when using sodium chlorate, and these results have been repeated with the A. F. C. Company's weed killer No. 2.

The Paris, Lyons & Mediterranean Company (P. L. M.) invented and put into use the process by *pulverisation* of *saturated solutions*, which made it practicable to clean by chemical methods the large surfaces involved in railway permanent way : at the present time 70 km. (43.5 miles) *i. e.* [350 000 sq. m. = 430 000 square yards] of track are cleared of weeds using only about 20 m³ (4 400 Br. gallons) of water, whereas when the surface was simply *watered* with the solution, 250 to 300 m³ (5 500 to 6 600 Br. gallons) were used. This method is the only one adopted by all French railways using chemical weed killers.

The first pulverisation of weed killers, tested in the stations were made by portable sprayers carried on the back, consisting of small closed reservoirs put under pressure when filling so that they worked without pumping. These equipments showed themselves to be entirely practical but in use the joints of the fittings were attacked by the sodium salts which led us to make up similar patterns but of « Armco » iron, autogeneously welded and vitreous-enamelled to protect them against oxidation.

These equipments however are emptied in ten minutes and can cover an area of only about 100 m² (120 sq. yards).

To deal with the track between stations an equipment able to cover a very large area and with a considerable capacity was needed.

It was thought desirable however, before building a large capacity equipment, to settle the technique of the process : the action is as though the plant were « asphyxiated » by the weed killer solution, and in addition as though the roots were affected. A consideration of the first action results in the product being divided into the finest possible spray, so that it is deposited on the leaves as a very fine mist which covers them with a multitude of very fine drops which upsets the respiratory function of the leaves over the whole surface.

On the other hand, the cost of labour had to be kept down as much as possible and consequently it was necessary to make provision for loading facilities proportional to the quantity of weed killer to be loaded at the supply stations and to get absolutely automatic distribution over the tracks so as to prevent by carelessness or lack of understanding insufficient material being used, thereby making the results doubtful, as well as too much which means a pure loss of the weed killer.

These conditions have been entirely met in the equipment used since 1927.

METHODS OF APPLICATION.

It will be appreciated that the cost due to pulverisation by means of a motor can be economised seeing that the power needed can be got from the axles of the carrying wagon which gives the advantage of automatically proportioning the quantity to be used to the speed of the train, as for a given density of vegetation, the quantity of solution to be applied per superficial metre should be constant.

The conductor should therefore not have to take any notice of the speed of running, but should solely concern himself with increasing the quantity of weed killer when the weeds are thick and reducing it when few as well as with not applying it in places the engines

themselves keep clean, and where it is not needed (platforms, etc.).

Further, the corresponding operations should be simple and quick without however, when shutting off any portion, affecting the quantity distributed by those remaining in use.

The Paris, Lyons & Mediterranean's equipment consists of a wagon (*a*) carrying the plant and one or two tank wagons. On the wagon (*a*), there is a 4-piston double-acting pump (*b*) so as to get a continuous flow, driven from one of the axles of the wagon.

The automatic action is got as follows : the liquid from the pump is driven into a collector (3) or feeder from which are taken the connections to the 15 sprayers (4) parallel to the rails. These sprayers are cylinders in which a piston (*p*) slides, this piston in the shut off position being kept at the inlet end by a long spring (*r*). These sprayers are fitted with spraying jets of small diameter which are completely covered, when out of use, by the piston.

On starting, the liquid forced in by the pump moves the piston in each sprayer and uncovers the jets; the springs limit the travel of the piston to the amount needed to get the required pressure behind the spayer. As the speed increases, the amount of liquid forced in increases and the springs are compressed more, thereby uncovering a larger number of jets : as the speed falls the pistons gradually return towards the inlet end, shutting off one by one the jets.

If it is not desired to spray from one or more of the sprayers for the sides of the track, which sprayers are branched off the same feeder as those for the track itself, the sprayers in question are shut off; this automatically opens a « by pass » (*fo*) which takes the liquid and returns it to the main reservoir. In this way there is no increased discharge from the sprayers remaining in use, nor any excess pressure in the latter. There is moreover no reduction in the load through this « leak » on the pump discharge side; the liquid passing loses its pressure just as though it had gone through the sprayer.

The variations in the quantity of liquid discharged to meet the varying density of vegetation are obtained by means of a speed change gear (V) of the *Fouillaron* type inserted between the axle drive and the pump gear. From the explanations given in the preceding paragraph, it will be appreciated that the position in which the change speed box indicator is set does not depend upon the number of sprays in use and that for a given gear the quantity discharged per superficial metre is constant whatever the width of ballast treated.

The number of jets on the P. L. M. machine is 405 and has been calculated for a maximum speed of 55 km. (34.2 miles) an hour (the speed goods trains booked to a maximum of 60 km. [37.3 miles] an hour do not exceed in practice). In this way the weed killer is always finely divided and at the high speeds remains in as fine a mist as at lower speeds, the number of jets in use being strictly proportioned to the speed (one jet per sprayer and per 2 km. [1.24 miles] variation in speed).

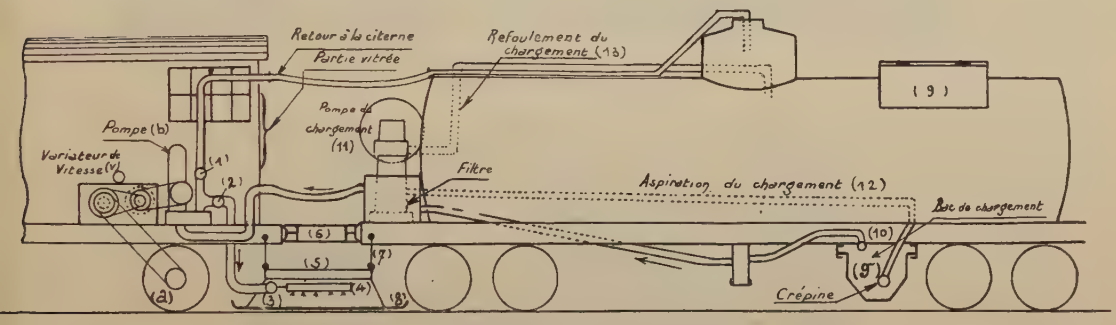
To sum up, the P. L. M. machine gives a spray always of the same fineness; the application, in spite of changes of speed, of a constant volume per unit of surface is obtained automatically, this constancy being automatically maintained even if the application to a width of ballast is cut out.

It is therefore impossible for part of the surface to be insufficiently sprayed, nor for any liquid to be lost and this is of very great importance as the cost of application is only about a tenth of the value of the solution used.

The constructional details of the P. L. M. machine are also very interesting : the sprayers are carried on a frame forming a cradle between the pump wagon, on which the control gear is located, and the tank wagon; they are thus under the eyes of the conductor; by this means if a jet is blocked by foreign matter — not of importance on the P. L. M. machine owing to the large number of jets used on the same sprayer — the operator notes it and cleans it at the first stop (without having to go under the wagon).

If anything unexpected occur, making it

Fig. 1.



De-compresser.
Shut off cock on distributing main.
Supply container for sprayer.
Sprayers.
Cradle for the sprayers.
Spring coupling.
Carrying links.
Shoes to protect rails.
Water tanks.

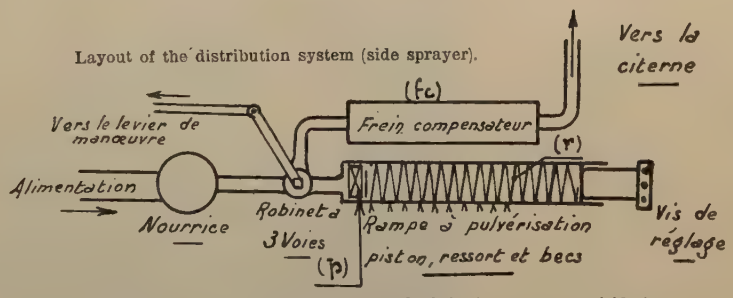


Fig. 2. — Paris, Lyons and Mediterranean weeding machine.

Explanation of French terms: Alimentation = Supply. — Bac de chargement = Loading container. — Crépine = Water strainer. — Filtre = Sieve. — Frein compensateur = Compensating brake. — Nourrice = Container. — Partie vitrée = Gauge glass. — Piston, ressort et becs = Piston, spring and jets. — Pompe (b) = Double-acting pump. — Pompe de chargement = Loading pump. — Rampe à pulvérisation = Sprayer. — Refoulement du chargement = Loading pipe (to tank). — Retour à la citerne = Return pipe to tank. — Robinet à 3 voies = 3-way cock. — Variateur de vitesse = Speed regulator. — Vers la citerne = To the tank. — Vers le levier de manœuvre = To the operating lever. — Vis de réglage = Adjusting screw.

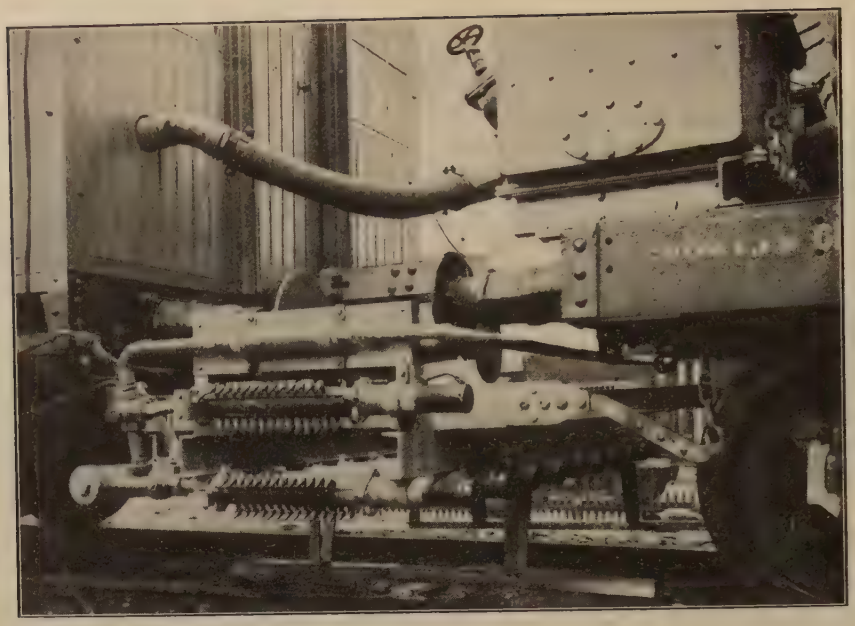


Fig. 3.

Fig. 4.

necessary to stop the machine working, it is only necessary to declutch and examine the fittings which are on the control wagon itself or on the cradle which latter can be got at whilst running if need be.

If it is only a question of a slight repair it can be made good and the plant then started up again without having had to lose the opportunity of treating the distance to be travelled to the booked stopping place.

LOADING ARRANGEMENTS.

The arrangements for preparing and taking in the weed killer solution have considerable importance from the point of view of cost, and there is no need to be afraid of making them sufficiently large nor of perfecting them so as to avoid any loss of time; in these respects our plant seems to us to have undoubted advantages.

The equipment when brought to a refilling station is gauged : the amount of material to be taken in involves :

a) a volume of water to be introduced into the plant;

b) a weight of weed killer salt.

Whilst the salt is being weighed out along a siding set aside by the Operating Department, the plant is run to a water column; the covers of the water tanks carried alongside the body of the tank are lifted and the gauge showing the height to which the fresh water is to be filled taking into account the weight of salt to be used, is read. The quantity of water needed is then taken; the plant is then run back to the siding where alongside it on the ground are the vessels filled with the sodium chlorate. A rectangular tank (T) running on wheels under the tank wagon frame and between the bogies is drawn from the loading platform side so as to come under the frame sideways : the men pick up the vessels with the chlorate and empty them into the tank without any difficulty, and at the same time a cock is opened to allow the liquid from the tank wagon to run into the tank. An endless screw driven from the motor stirs up the chlorate and the water which wets it before it is transferred by the pump to the tank wagon.

The pump which pumps up the wetted salt is a powerful sand type pump of 16 to 20 m^3 (565-705 cubic feet) per hour capacity driven by a 10-H. P. motor; the suction and delivery pipes have been given a length of at least twice that of the tank wagon, so that by the time it is discharged through the dome into the tank the sludge has been converted into a syrupy and very soluble liquid which readily mixes with the water already in the tank.

To take in a full tank (23.85 m^3 [5 246 Br. gallons] of water and 6 250 kgr. [13 780 lb.] of sodium chlorate) requires 40 minutes excluding the shunting of the wagon into position.

When using No. 2 weed killer (14.4 m^3 [3 168 Br. gallons] of water and 10 600 l. [2 330 Br. gallons] of weed killer) filling up the tank simply consists in emptying the barrels of weed killer directly from the wagon in which they come, into the tank without it being necessary to unload the barrels from the wagons.

There is a complete filtering system and this prevents any impurities etc. in the water and chlorate from getting into and blocking the spray nozzles.

Finally the plant as a whole and the method of working adopted have given the following results : we obtained during one of the first spring operations over a length of 5 000 km. (3 107 miles) an average of 94 km. (58.4 miles) of track weeded per working day, that is about an area of 500 000 m^2 (598 000 sq. yards). This amount was increased to about 125 km. (77.7 miles) during the last series of operations because we had added a second tank wagon of 25 m^3 (5 500 Br. gallons) capacity which reduced the number of stops for refilling and made it possible to treat 9 500 km. (5 903 miles) with one set of equipment during favourable weather.

The contents of two 25-m^3 tanks was sufficient to clear 130 to 140 km. (80.8 to 87 miles) of single tracks : on certain days the length cleared exceeded 200 km. (124 miles).

From the data collected since the first intensive chemical weeding campaign of 1927, we have been able to draw up an approximate balance sheet for the different methods of weeding.

Hand weeding varies with the density of the weeds and may cost for labour as much as 1 500 fr. per km. (2 415 fr. per mile). In certain areas where the weeds are very dense, the gang has to go over the ground twice. The time the track remains clear depends upon the weather conditions and the care taken in carrying out the work.

In any case however, a large proportion of the roots are left in the ballast. Mechanical weeding costs us on the average about 500 fr. per km. (805 fr. per mile), including the cost of running, removing the weeds and tightening up the rail fastenings if needed, etc.

As regards high capacity chemical weeding, the cost is made up of the cost of the chemicals, varying in different countries, and the cost of application. Taking sodium chlorate at 3 fr. the kgr. (1.36 fr. per lb.), the cost is about 265 fr. per km. (426.5 fr. per mile).

As regards its application, the price for amortization and maintenance of the plant, taking in water and the chemicals, the supervision of the work out on the line, and all accessory expenditure is barely 25 fr. (40.2 fr. per mile).

The total cost is therefor less than 300 fr. per km. (482.8 fr. per mile) of track treated taken on a width of 6 m. (19 ft. 8 in.).

[385. (09.2]

OBITUARY

Max WEISS,

Chief Engineer,
Technical Advisor of the General Management of the Swiss Federal Railways,
Delegate at the Sessions held at Washington (1905), Berne (1910), Rome (1922), London (1925) and Madrid (1930)
by the International Railway Congress Association,
Reporter and Sectional President at the London Session (1925),
Sectional Vice-president at the Madrid Session.

We were painfully affected by the news of the death on 29 October 1930 of one of our devoted collaborators, Mr. Max Weiss, Chief Engineer of the Swiss Federal Railways.

Whilst he was still quite young, Mr. Weiss already took a keen interest in railways.

He studied at the Zurich Federal Polytechnic School and received the diploma of Mechanical Engineer in 1896. In February of that year, after having spent some time in the offices of the Swiss Locomotive Works at Winterthur, he entered the service of the Jura-Simplon Railway.

He passed some time abroad and in various locomotive constructional Works and then, shortly after the nationalisation of the first private companies in Switzerland, he was appointed, on 1 July 1902, first class Mechanical Engineer by the Federal Railways and was placed in charge of the locomotive and carriage constructional offices.

He was in his true domain there and, on 1 September 1905, he was appointed assistant to the Chief Engineer, in charge of the Locomotive Running Department, whilst still continuing to handle in the most competent manner questions concerning the construction of rolling stock.

In February 1919, Mr. Weiss was appointed Chief Engineer, in charge of the Locomotive Running Department of the Federal Railways. His work became extraordinarily heavy when this Administration decided to accelerate the electrification of their system; but Mr. Weiss faced the additional work with extraordinary energy and a zeal which nothing could defy.

When the Federal Railways were reorganised, he was relieved of part of his duties which had become too heavy for a single man to look after and, on 1 February 1928, the General Management entrusted him with the study of questions relating to the construction of locomotives and rolling stock, with the title of Chief Engineer and Technical Advisor.

Mr. Weiss was much esteemed not only in European technical circles, but also abroad.

He took a very active part in the sessions of the International Railway Congress Association which have been held from the year 1905 onwards and played a very important role in two of these sessions : he was reporter on question V: « High speed electric locomotives » and president of the 2nd Section (Locomotives and Rolling Stock) at the London Congress (1925), and vice-president of the same Section at the Madrid Congress.

Our Association loses in him one of its most fervent adepts.

We wish to repeat our sincere condoleances to his widow, Mrs. Weiss, and his family, as also to the General Management of the Swiss Federal Railways.

The Executive Committee.

ONTHLY BIBLIOGRAPHY OF RAILWAYS [1]

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General secretary of the Permanent Commission of the International Railway Congress Association.

(JULY 1930)

016 .385. (02]

I. — BOOKS.

In French.

930 691

HENONT (L.).

brique armée homogène.

ris et Liége : Librairie polytechnique Ch. Béranger. olume de 393 pages (16 × 24 cm.). (Prix : 90 fr.)

930 531. (02

LVIN (J.).

urs de mécanique appliquée aux machines (6e vol., partie, 3e édition mise à jour par G. Van Engelen).

ris : Albin Michel, 22, rue Huyghens. Un vol., pages, 2 planches et 265 figures. (Prix : 40 francs.)

930 621

IDRON (L.).

de-mémoire du constructeur de chaudronnerie.

ris : Dunod, 92, rue Bonaparte, 1 vol. (13 × 21 cm.) 26 pages, 102 figures. (Prix : 35 francs.)

930 621

ENARD (H.).

a rectification des pièces mécaniques.

ris: Dunod, éditeur, 1 vol. (16 × 25 cm.), 252 pages, figures. (Prix : relié, 61 francs; broché : 52 francs.)

929 651

OB (J.).

es appareils transporteurs mécaniques de bureau.

aris (6e). Dunod, 92, rue Bonaparte. Un vol. × 16 cm.), de VIII + 231 pages, 213 fig. (Prix hé : 51 francs.)

930 621 .392

RUN (M.).

a soudure électrique à l'arc et ses applications.

ris : Bibliothèque de l'Office Central de la Soudure gène, 104, boulevard de Clichy. Un vol. (13 × 22 ; 252 pages, avec 212 figures. (Prix : 20 francs.)

1930 385 .587

TAYLOR (F. W.).

La direction des ateliers (Etude suivie d'un mémoire sur l'emploi des courroies). Traduction française de L. Descroix.

Paris (6e) : Dunod, 92, rue Bonaparte. Un volume (16 × 25 cm.), VI-190 pages. (Prix : 28 francs.)

In German.

1930 385. (02 (.43)

BAUMANN (H.).

Deutscher Reichsbahn-Kalender 1930.

Berlin-Leipzig : Konkordia Verlag. (Preis : 4.00 Rm.)

1929 621 .83

TEN BOSCH (M.).

Vorlesung über Maschinenelemente.

Berlin. Verlag von Julius Springer. II, 97 Seiten. (Preis geh. : 7.80 Rm.)

1930 385. (02 & 656 .23

Handbuch für Eisenbahn und Tarifwesen.

Unter Mitarbeit hervorragender Eisenbahn- und Tariffachmänner, darunter **Dr. KARL FENZL.**

Prag III : Verein deutscher Eisenbahnbeamten, Vsehrdová. 2.

1929 385 .1 (.73)

HOMBERGER (L.).

Wirtschaftsführung und Finanzwesen bei amerikanischen Eisenbahnen.

Berlin. Verlag der Verkehrswissenschaftlichen Lehrmittelgesellschaft m. b. H. bei der Deutschen Reichsbahn. (Preis : 4.80 Rm.)

1929 621 .133.1 & 697

LANDSBERG (Fr.).

Wärmewirtschaft im Eisenbahnwesen. (Band VII der Sammlung « Wärmelehre und Wärmewirtschaft »).

Dresden und Leipzig. Verlag von Theodor Steinkopff. 207 Seiten mit 80 Abbildungen. (Preis : 13.00 Rm.; geb. 14.50 Rm.)

[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by Weissenbruch in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1929 385 (.43)
QUAATZ.
Sicherheit und Wirtschaft bei der Reichsbahn.
Berlin, Verlag von Reimar Hobbing. In-8°, 142 Seiten. (Preis : 5.00 Rm.)

1929 621 .43
SAFS (F.).
Kompressorlose Dieselmaschinen (Druckeinspritzmaschinen).
Berlin : Verlag von Julius Springer. 395 Seiten mit 328 Textabbildungen. (Preis geb. : 52 Rm.)

1929 656 .25 (.43)
SCHNEIDER (F.) & GOTTER (K.).
Die **Deutsche Eisenbahn-Signalordnung** in Wort und Bild.
Teil III : Die **Signale auf den Bahnhöfen.**
Berlin. Verlag der Verkehrswissenschaftlichen Lehrmittelgesellschaft. Din. A. 5, 50 Seiten. (Preis geb. : 1.50 Rm.)

1930 625 .13 (.460 + .64)
STRAUSS (Friedrich).
Ein Tunnel unter der Meerenge von Gibraltar.
Wien-Leipzig : Kommissionverlag Sellmayerische Buchhandlung. (Preis : 1 Rm. oder 1.80 Schelling.)

In English.

1930 621 .135. (01
DALBY (W. E.).
The balancing of engines.
London : Edward Arnold & Co. Fourth Edition. 1 vol., (9 1/2 in. × 6 in. × 1 in.); 321 pp. (Price : 21 sh. net.)

1930 385. (09 (.42)
DENDY MARSHALL (C. F.).
Centenary history of the Liverpool and Manchester Railway.
London : The Locomotive Publishing Company. (Price : 30 sh. net.)

1930 691
Deterioration of structures in sea-water.
(Ninth interim report of the Committee of the Institution of Civil Engineers, Department of Scientific and Industrial Research.)
London. W. C. 2. His Majesty's Stationery Office, Kingsway. 102 pp., diagrams and plates. (Price : 3 sh. 6 d. net.)

1930 656 .213
BULKELEY (George), A. M. I. Mech. E., Port Manager, Kenya and Uganda Railways and Harbours.
Railway and seaport freight movement, with examples of British and American practice.
London, E. C. 4. Crosby Lockwood and Son, Stationers' Hall Court, Ludgate Hill. 1 volume, Royal 8°, 240 pages, diagrams, half-tone plates and folding plans. (Price [cloth] : 28 sh. net.)

1930 385 .3 (.4
Form of accounts and statistical returns — annotat
to show the manner in which they are to be compil
under the provisions of Section 77 (1) of the Railwa
Act, 1921.
London, W. C. 2. Published by H. M. Statione
office, Adastral House, Kingsway. (Price : 4 sh. net.)

1929 669. (
HAYWARD (Carle R.).
Outline of metallurgical practice.
New York : D. Van Nostrand Co. 1 vol., cloth (6 ×
inches), 612 pp., illustrations, diagrams, tables. (Pric
$ 7.50).

1930 625 .3 (.73) & 625 .4 (.7
Index to « Consolidation of Railroads », 159 I. C.
522.
Washington, D. C. Published by Library, Bureau
Railway Economics, 37 pages. (Apply.)

1930 625 .1 (09 (.5
INDIAN RAILWAY BOARD.
History of Indian railways constructed and in pr
gress.
Calcutta. Government of India Central Publicati
Branch. 1 vol. (13 × 8 1/4 inches), 281 pp., with foldi
coloured map and plates. (Price : Rs. 5.8 or 9 sh.)

1929 6
Mc MILLAN (F. R.), Director of research, Portland C
ment Association.
Basic principles of concrete making.
New York and London : Mc Graw-Hill Book
1 vol. Cloth (6 × 9 inches), 99 pages, 32 line cuts a
halftones. (Price : $ 2.)

1929 621 .4 (
Oil engine power plant handbook (fifth edition).
New York : National Trade Journals, Inc. 1 v
cloth (8 × 11 inches), 288 pages, illustrated. (Pric
$ 5.)

1929 621 .139 (.73), 625 .18 (.73) & 625 .27 (.7
PARTINGTON (J. E.).
Railroad purchasing and the business cycle.
Washington D. C. Published by Booking Institut
309 pages. (Price : $ 3.00.)

1930 6
PITMAN's shorthand writers' railway phrasebook
London, W. C. 2. Sir Isaac Pitman & Sons Ltd., Parl
street. 1 vol. (4 1/4 × 6 1/2 × 3/8 in.), 83 pp. (Pric
2 sh.)

1930 625 .111. (
SEARLES (W. H.) & IVES (H. C.).
Field engineering.
London : Chapman & Hall. Twentieth editi
(6 3/4 × 4 in. × 1 in.); 728 pp., 153 fig.; 4 plat
(Price : 20 sh. net.)

1930 656 (.51)
RINGER (H.).
China : A new aspect.
London, W. C. 1. H. F. & G. Witherby, 326, High lborn. 1 vol. (8 3/4 in. × 5 1/2 in. × 1 1/2 in.), pp.

1930 691
OMAS (W. N.).
The use of calcium chloride or sodium chloride as a tection for mortar or concrete against frost. (Building earch, report No. 14.)
London : His Majesty's Stationery Office. (Price : . net.)

1929 313 .656.1 (.3)
World highway transport : A statistical survey.
Paris. International Chamber of Commerce, 38. Cours ert Ier. Brochure N° 70, 58 pp. (Price : 1 sh.)

1930 669 .1
YNN (E. E.).
Metal pickling.
Manchester : Charles Sever Limited, 40, King Street st. (Price : 2 sh. 6 d.)

In Spanish.

1928 69. (02
ESSELBORN (Carlos).
Tratado general de construcción. — Construcción de edificios. — Tomo I, escrito con la colaboracion de L. Brennecke, B. Kossmann, G. Rüth, H. Steinberger y R. Weder. — Versión de la 8ª edición alemana por el Dr. B. Bassegoda Musté, arquitecto.
Barcelona : Gustavo Gili, editor. 1 vol. (19.5 × 28 cm.) ; 765 p. con 2 351 fig. (Precio : 58 pesetas.)

In Italian.

1929 691
NARDUCCI (Luigi).
Prontuario per calcolo e l'esecuzione del **cemento armato nelle costruzioni civili.** Seconda edizione rifatta ed aumentata.
Torino : S. Lattes & C., editori. 1 volume in 16° con 109 figure, 22 tabelle corredate de numerosi esempi applicativi. (Prezzo : L. 25.)

016 .385. (05]

II. — PERIODICALS.

In French.

Arts et Métiers. (Paris.)

1930 621 .43
s et Métiers, février, p. 3.
MARCOTTE (E.). — **La réalisation des moteurs ides à huile lourde.** (8 400 mots & fig.)

Bulletin de la Société d'encouragement pour l'industrie nationale. (Paris.)

1929 621 .392
l. de la Société d'Encourag. pour l'Industrie nationale, novembre, p. 751.
BRILLIÉ (J.). — Progrès récents réalisés dans les iveaux procédés de **soudure électrique.** (6 600 mots fig.)

Bulletin de la Société des Ingénieurs civils de France. (Paris.)

1929 621 .14
l. de la Soc. des ing. civ. de France, juill.-août, p. 852.
PÉRISSÉ (R.). — **Les théories modernes de graissage.** 00 mots, 4 tableaux & fig.)

Bulletin Technique de la Suisse Romande. (Vevey.)

1930 621 .31 (.494)
Bull. technique de la Suisse Romande, n° 1, 11 janv., p. 1; et n° 2, 25 janv., p. 13.
Les forces motrices de Brusio. (6 300 mots & fig.)

Chronique des transports. (Paris.)

1930 385 .13 (.65)
Chronique des transports, n° 2, 25 janvier, p. 2.
Impôts et tarifs ferroviaires. La solution de l'Algérie. (1 800 mots.)

Génie civil. (Paris.)

1930 656 .212.7 (.44)
Génie civil, n° 2, 11 janvier, p. 29.
DANTIN (Ch.). — Les nouvelles **halles du service des messageries** de la gare de Paris-Austerlitz. (4 300 mots & fig.)

1930 621 .112 (.73)
Génie civil, n° 2, 11 janvier, p. 37.
L'emploi de **pressions élevées** dans les stations centrales à vapeur. La centrale de Holland (New-Jersey, E. U.). (3 200 mots & fig.)

1930 621 .132.8 (.42)
Génie civil, n° 3, 18 janvier, p. 66.
Nouvelle **locomotive compound à quatre cylindres**, du London and North Eastern Railway. (1 200 mots & fig.)

1930 651 (.44) & 655 (.44)
Génie civil, n° 4, 25 janvier, p. 77.
CALFAS (P.). — Les **machines à imprimer les billets** au moment de leur délivrance. Leur emploi aux Chemins de fer de l'Etat. (3 800 mots & fig.)

1930 621 .116
Génie civil, n° 4, 25 janvier, p. 91.
La désincrustation mécanique des chaudières par la « magnétine ». (600 mots.)

1930 624 .63 (.44)
Génie civil, n° 5, 1er février, p. 101.
VALLETTE (R.). — **Pont en béton armé** de 126 mètres de portée, sur l'Oise à Conflans-Fin-d'Oise, près Paris. (4 600 mots & fig.)

1930 621 .335 (.494)
Génie civil, n° 6, 8 février, p. 125.
ALTORFER (P.). — **Locomotive à crémaillère et à adhérence** du Chemin de fer électrique Viège-Zermatt (Suisse). (2 800 mots & fig.)

1930 62. (01
Génie civil, n° 6, 8 février, p. 128.
CHAUDY (F.). — Le **flambement des arcs et des membrures comprimées des poutres droites.** (2 200 mots & fig.)

1930 624 .61
Génie civil, n° 6, 8 février, p. 134.
L'élargissement du Pont de la Concorde à Paris. (1 200 mots & fig.)

1930 621 .43
Génie civil, n° 6, 8 février, p. 135.
Dispositifs d'injection mécanique pour moteurs Diesel. (2 300 mots & fig.)

La Science et la Vie. (Paris.)

1930 625 .245 (.44)
La Science et la Vie, mars, p. 225.
CAËL (J.). — Une **voiture-laboratoire** vérifie périodiquement l'état des voies de chemins de fer. (2 000 mots & fig.)

Les chemins de fer et les tramways. (Paris.)

1930 385. (01 (.6)
Les chemins de fer et les tramways, février, p. 23.
SPIESS (E.). — **Le transsaharien.** (3 700 mots & fig.)

1930 669 .1
Les chemins de fer et les tramways, février, p. 28.
CROZET (A.). — **La parkérisation.** (2 000 mots, 1 tableau & fig.)

1930 625 .21
Les chemins de fer et les tramways, février, p. 32.
FRONTARD (P.). — **La construction et l'emploi de bâtis d'essieux à rouleaux.** (2 400 mots & fig.)

1930 621 .33
Les chemins de fer et les tramways, février, p. 37.
Contrôleur de vigilance de la Compagnie du P. O (1 000 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1929 625 .15 & 669 .1
L'Ind. voies ferrées et transp. autom., déc., p. 471.
MARTHOUREY (P.). — Les **aciers spéciaux résistant** à l'usure, pour appareils de voie (à suivre). (5 300 mots 3 tables & fig.)

Revue générale des chemins de fer. (Paris.)

1930 625 .212 (.44)
Revue générale des chemins de fer, février, p. 118.
DAGORY. — **Réparation des boudins usés des roues** par apport de métal, dans les ateliers du service électrique des Chemins de fer de l'Etat. (3 000 mots & fig.)

1930 656 .211 (.44)
Revue générale des chemins de fer, février, p. 125.
SORGUES (Ch.). — **Travaux d'agrandissement de la gare de Vichy.** (4 200 mots.)

1930 625 .617 (.44)
Revue générale des chemins de fer, février, p. 138.
BACLE. — **Truck transbordeur** du chemin de fer de Somain à Anzin et à la frontière belge. (1 200 mots & fig.)

1930 385 .113 (.42)
Chemins de fer de la Grande-Bretagne. (7 500 mots 3 tables.)

Revue politique et parlementaire. (Paris.)

1930 656 .2
Revue politique et parlementaire, 10 janvier, p. 56.
PRADEL. — **Les tarifs de chemins de fer dans le trafic international.** (2 800 mots.)

Revue Universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliqués à l'industrie. (Liége.)

1930 621 .11
Revue Universelle des Mines, n° 2, 15 janvier, p. 48.
TILMAN (J.). — **Considérations sur le problème du graissage des mécanismes.** (3 100 mots & fig.)

1930 624 .2

Revue Universelle des Mines, n° 3, 1er février, p. 71.

BERKOWICZ (B.). — Une méthode de calcul des **poutres continues** à appuis équidistants. (3 200 mots & fig.)

1930 621 .83

Revue Universelle des Mines, n° 3, 1er février, p. 79.

BODART (E.). — Les **procédés modernes de vérification des roues dentées.** (2 400 mots & fig.)

Revue universelle des transports et des communications. (Paris.)

1930 388 (.45)

Revue univers. des transp. et des commun., janv., p. 2.

VALLECHI (U.). — Le projet des **chemins de fer métropolitains** de Rome. (4 300 mots & fig.)

1930 625 .151

Revue univers. des transp. et des commun., janv., p. 10.

CAPITAN (H.). — Le **ralentissement sur les aiguilles prises en pointe en voies principales.** (3 200 mots.)

1930 624 .51

Revue univers. des transp. et des commun., janv., p. 14.

ZEHNDER-SPOERRY (R.). — Quelques notes sur la construction des **ponts suspendus,** particulièrement aux Etats-Unis (à suivre). (2 800 mots & fig.)

In German.

Electrotechnische Zeitschrift. (Berlin.)

1930 625 .62 (09 (.431)

Elektrotechnische Zeitschrift, Heft 4, 23. Januar, S. 127, Heft 5, 30. Januar, S. 164 und Heft 7, 13. Februar, S. 244.

REICHEL (W.). — **Elektrische Stadtbahn** von der Siemensschen Bahn 1879 bis zur Berliner Stadtbahn. (11 700 Wörter & Abb.)

1930 621 .331 (.436)

Elektrotechnische Zeitschrift, Heft 5, 30. Januar, S. 169.

ASCHER (H.). — Das **Stubachwerk** der Österreichischen Bundesbahnen. (1 000 Wörter & Abb.)

1930 625 .245 (.43)

Elektrotechnische Zeitschrift, Heft 6, 6. Februar, S. 219.

Die **Beförderung von Transformatoren** auf Eisenbahnen. (1 300 Wörter & Abb.)

1930 621 .335 (.43)

Elektrotechnische Zeitschrift, Heft 8, 20. Februar, S. 265.

PUNGA (F.). — Über den **Betrieb einer Verschiebeanlage** mit Lokomotiven für Wechselstrom von 50 Hz. (4 700 Wörter & Abb.)

Elektrische Bahnen. (Berlin.)

1930 621 .33 (.3)

Elektrische Bahnen, Januar, S. 1.

WECHMANN (W.). — Die **elektrische Zugförderung** auf ausserdeutschen Bahnen. (4 000 Wörter & 4 Tabellen.) (Fortzetzung folgt.)

1930 621 .335 (.494)

Elektrische Bahnen, Januar, S. 10.

Die **Wechselstrom-Triebwagen** Gattung CFe 4/5 der Bern-Neuenburg-Bahn und der Loetschbergbahn. (2 400 Wörter & Abb.)

1930 621 .335 (.492)

Elektrische Bahnen, Januar, S. 18.

SPIES (R.). — Die **Triebwagen** für 1 500 Volt Gleichstrom der niederländischen Staatsbahnen. (1 600 Wörter & Abb.)

1930 621 .335

Elektrische Bahnen, Januar, S. 22.

BALKE (H.). — **Sicherheitsfahrschaltung** für elektrische Hauptbahn-Fahrzeuge. (1 300 Wörter & Abb.)

Glasers Annalen. (Berlin.)

1930 621 .134.1

Glasers Annalen, Heft 1, 1. Januar, S. 3; und Heft 2, 15. Januar, S. 15.

EWALD (K.). — Ein Weg zur **Vereinheitlichung der Steuerungen** gefeuerter Kolben-Dampflokomotiven. (5 200 Wörter & Abb.)

1930 656 .254

Glasers Annalen, Heft 1, 1. Januar, S. 9.

Die selbsttätige Sicherung von **Eisenbahnüberwegen.** (2 100 Wörter & Abb.)

1930 621 .131.1

Glasers Annalen, Heft 2, 15. Januar, S. 18.

GOTTSCHALK (M.). — **Lokomotiv-Besandungsanlagen.** (5 500 Wörter & Abb.)

1930 625 .24

Glasers Annalen, Heft 3, 1. Februar, S. 29.

PHILIPP. — **Rationalisierung** in der Waggonindustrie. (3 500 Wörter und Abb.)

1930 621 .132.8 (.43) & 621 .43 (.43)

Glasers Annalen, Heft 3, 1. Februar, S. 35.

WITTE. — Die Fertigstellung der ersten 1 200 P. S. **Diesel-Lokomotive** für die Reichsbahn. (3 000 Wörter & Abb.)

In English.

Electric Railway Journal. (New York.)

1930 385 .11 (.73)

Electric Railway Journal, January, p. 3.

Electric railway industry in more favorable position. (2 800 words, 1 table & fig.)

1930 385 .11 (.73)
Electric Railway Journal, January, p. 9.
Expenditures for improvements mount upward. (3 200 words, 3 tables & fig.)

1930 385 .11 (.73)
Electric Railway Journal, January, p. 13.
RICHEY (A. S.). — **Electric railway costs and fares.** (1 100 words & fig.)

1930 625 .1 (.73)
Electric Railway Journal, January, p. 15.
MILLER, Jr. (J. A.). — **Industry strengthened by trackage readjustement.** (1 600 words, 5 tables & fig.)

1930 656 .1 (.73)
Electric Railway Journal, January, p. 20.
STAUEFFER (J. R.). — **Bus operations are steadily expanded by electric railways.** (1 800 words, 8 tables & fig.)

1930 621 .338 (.73)
Electric Railway Journal, January, p. 33.
VAN DER STEMPEL (Th. M.). — **Rolling stock purchases largely increased.** (2 100 words, 5 tables & fig.)

1930 621 .33 (.73) & 656 .1 (.73)
Electric Railway Journal, January, p. 37.
Interest revived in trackless trolley operations. (2 700 words, 3 tables & fig.)

1930 385 .1 (.73)
Electric Railway Journal, January, p. 41.
BUCK (M.). — **Great improvement in financial situation.** (2 600 words, 12 tables & fig.)

1930 625 .1 (.73)
Electric Railway Journal, January, p. 46.
Much construction work features heavy electric traction 1929. (900 words & 2 tables.)

1930 621 .336 (.73)
Electric Railway Journal, January, p. 48.
Low records made in trolley wire breaks. (1 500 words & fig.)

Engineer. (London.)

1929 62. (01 & 669
The Metallurgist, p. 189, supplement to the Engineer, 27 December.
The hardness test in practice. (1 300 words.)

1929 669 .1
The Metallurgist, p. 191, supplement to the Engineer, 27 December.
The range of reduced ductility in 18 : 8 chromium-nickel iron. (1 200 words.)

Engineering. (London.)

1930 621 .116
Engineering, No. 3336, 20 December, p. 796.
THORNTON (B. M.). — **A method of loading boilers for maximum fuel economy.** (3 100 words & fig.)

1930 621 .82
Engineering, No. 3336, 20 December, p. 801 and No. 3337, 27 December, p. 836.
CHARNOCK (G. F.). — **Bearings for line-shafting** (5 700 words & fig.)

1930 669 .1 (06 (.73)
Engineering, No. 3337, 27 December, p. 803.
The American Iron and Steel Institute (Annual meeting, 25 October 1929). (2 300 words.)

1930 669 .1
Engineering, No. 3337, 27 December, p. 816.
HULTGREN (A.). — **Crystallisation and segregation in small 1.10 per cent carbon-steel ingots.** (3 600 words & fig.)

1930 621 .331 (.43)
Engineering, No. 3337, 27 December, p. 825.
Mercury-arc rectifiers for the Berlin suburban railways. (2 000 words & fig.)

1930 621 .81
Engineering, No. 3337, 27 December, p. 827.
GORFINKEL (A.). — **Critical speeds of crankshafts.** (3 400 words, 1 table & fig.)

1930 621 .9
Engineering, No. 3337, 27 December, p. 838.
Piston and piston-rod machining operations. (2 200 words & fig.)

1930 625 .245 (.42)
Engineering, No. 3337, 27 December, p. 848.
40-ton side discharging coal wagons for the London Midland and Scottish Railway. (900 words & fig.)

1930 621 .132.8 (.42) & 621 .134.3 (.42)
Engineering, No. 3337, 27 December, p. 850.
High-pressure 4-6-2 type locomotive on the London and North Eastern Railway. (900 words & fig.)

1930 621 .132.8 (.45)
Engineering, No. 3338, 3 January, p. 8.
Rail-car with airless injection engine. (2 200 words & fig.)

1930 621 & 669 .3
Engineering, No. 3338, 3 January, p. 26.
Experiments on laminated springs. (900 words & fig.)

1930 621 .95 (.42
Engineering, No. 3338, 3 January, p. 29.
High-speed automatic drilling machines. (800 words & fig.)

1930 621 .133.
Engineering, No. 3338, 3 January, p. 30.
HUDSON (O. F.), HERBERT (T. M.), BALL (F. E.) and BUCKNALL (E. H.). — **Properties of locomotive firebox stays and plates.** (3 600 words & tables.)

1930 621 .134.
Engineering, No. 3339, 10 January, p. 38.
Three-cylinder locomotive fitted with rotary cam poppet valve gear. (1 000 words & fig.)

1930 621 .4
gineering, No. 3339, 10 January, p. 44.
Fuel-research set with variable-compression engine. 200 words & fig.)

1930 621 .116
gineering, No. 3339, 10 January, p. 58.
LOFFLER (Prof. von St.). — **The generation of super-essure steam.** (3 500 words & fig.)

1930 621 .9
gineering, No. 3339, 10 January, p. 62.
Electrically-operated rotary scalings tools. (1 000 rds & fig.)

1930 669
gineering, No. 3340, 17 January, p. 65.
FOX (J.). — **The measurement of initial stresses in rd-drawn tubes.** (2 500 words, 1 table & fig.)

1930 656 .1
gineering, No. 3340, 17 January, p. 81.
Road transport and the public. (1 700 words.)

1930 625 .245 (.55)
gineering, No. 3341, 24 January, p. 102.
30-ton railway wagon for 3-ft. gauge. (400 words fig.)

Engineering News-Record. (New York.)

1930 625 .13 (.73)
gineering News-Record, No. 24, 12 December, p. 916.
Heavy construction on new line for Louisville & Nash-le Railroad. (2 200 words & fig.)

1930 625 .143.3
gineering News-Record, No. 24, 12 December, p. 926.
Tranverse fissures in rails; their cause and preven-n. (700 words.)

1930 621 .392. (.73)
gineering News-Record, No. 24, 12 December, p. 928.
gineering News-Record, No. 25, 19 December, p. 964.
PRIEST (H. M.) and MOSS (H. H.). — **Gas-welding sign and erection on a 300-ton mill building.** (4 500 rds, 3 tables & fig.)

1930 624 .1 (.73)
gineering News-Record, No. 25, 19 December, p. 959.
Novel sinking equipment for steel cylinder founda-ns. (1 200 words & fig.)

1930 624 .8 (.73)
gineering News-Record, No. 25, 19 December, p. 970.
PITTENGER (H. W.). — **Motors and control for vable bridges.** (2 800 words & fig.)

1930 721 .3 & 669 .1
gineering News-Record, No. 26, 26 December, p. 999.
JOHNSTON (R. S.). — **Tests of large-size columns three grades of structural steel.** (2 500 words, 2 tables fig.)

1930 625 .7 (.73)
Engineering News-Record, No. 1, 2 January, p. 4.
Mac DONALD (T. H.). — **How highway financing has evolved.** (2 300 words, 3 tables & fig.)

1930 625 .7 (.73)
Engineering News-Record, No. 1, 2 January, p. 8.
BROSSEAU (A. J.). — **Financing State and Inter-state highways.** (2 200 words & fig.)

1930 625 .7 (.73)
Engineering News-Record, No. 1, 2 January, p. 12.
LEARNED (E. P.). — **Gasoline taxes.** — Theory, practice and hazards. (4 400 words & fig.)

1930 625 .7 (.73)
Engineering News-Record, No. 1, 2 January, p. 17.
BRINDLEY (J. E.). — **Highway financing by special assessment.** (3 300 words & fig.)

1930 625 .7 (.73)
Engineering News-Record, No. 1, 2 January, p. 21.
AGG (Th. R.). — **Federal aid for roads.** (1 900 words.)

1930 625 .7 (.73)
Engineering News-Record, No. 1, 2 January, p. 24.
ECKELS (S.). — **County and township financing.** (2 000 words.)

1930 693
Engineering News-Record, No. 2, 9 January, p. 62.
MERRIMAN (Th.). — **Durability of Portland cement.** (3 200 words, 1 table & fig.)

1930 625 .13
Engineering News-Record, No. 2, 9 January, p. 74.
Value of mechanical ventilation in tunnel driving. (1 600 words.)

Mechanical Engineering. (New York.)

1930 621 .116
Mechanical Engineering, section 1, January, p. 13.
MANGELSDORF (T. A.). — **Progress in fuel utilization in 1929.** (6 800 words.)

1930 669 .1
Mechanical Engineering, section 1, January, p. 23.
SNELLING ROBINSON (C.). — **Progress in the iron and steel industry in 1929.** (2 300 words.)

1930 621 .85
Mechanical Engineering, section 1, January, p. 26.
CONDIT (K. H.). — **Progress in machine-shop practice.** (2 200 words.)

1930 385 .587
Mechanical Engineering, section 1, January, p. 28.
CONRAD (W. L.). — **Progress in industrial management.** (3 400 words.)

1930 656 .212.6
Mechanical Engineering, section 1, January, p. 32.
SMITH (E. D.). — **Progress in materials handling.** (3 500 words.)

1930 621 .4
Mechanical Engineering, section 1, January, p. 38.
Progress in oil- and gas- power engineering. (2 000 words.)

1930 621 .1
Mechanical Engineering, section 1, January, p. 47.
GIBSON (F. M.). — **Progress in steam-power engineering.** (2 600 words.)

1930 621 .13
Mechanical Engineering, section 1, January, p. 57.
Progress in railroad mechanical engineering. (2 700 words.)

Modern Transport. (London.)

1930 621 .134.2 (.42)
Modern Transport, No. 567, 25 January, p. 3.
New equipment for London & North Eastern Railway, locomotives. — **Beardmore Caprotti valve gear for 4-6-0 type passenger engines.** (800 words & fig.)

1930 656 .254 (.42)
Modern Transport, No. 567, 25 January, p. 4.
Development in train describing. (1 200 words & fig.)

1930 625 .4 (42 + 44)
Modern Transport, No. 567, 25 January, p. 6.
The Channel tunnel. (700 words.)

1930 621 .133.1 (.43) & 621 .137.1 (.43)
Modern Transport, No. 567, 25 January, p. 7.
Pulverised coal burner for locomotives. — German device for burning lignite. (1 100 words & fig.)

1930 656 .1 (.43) & 656 .2 (.43)
Modern Transport, No. 567, 25 January, p. 8.
Road and rail transport in Germany. — Coordination and competition. (1 500 words.)

1930 625 .258 (.494) & 656 .212.6 (.494)
Modern Transport, No. 567, 25 January, p. 7.
New marshalling yard for Swiss Federal Railways. (100 words & fig.)

Railway Age. (New York.)

1929 656 .213 (.73)
Railway Age, Section one, 28 December, p. 1463.
MOFFETT (J. W.). — Railroads build **modern produce terminal** at Detroit. (4 800 words & fig.)

1929 385 .3 (.73) & 385 .4 (.73)
Railway Age, Section one, 28 December, p. 1469.
Interstate Commerce Commission consolidation plan. (4 900 words & fig.)

1929 621 .132.5 (.73
Railway Age, Section one, 28 December, p. 1477.
Great Northern adds to 2-8-8-2 type motive powe (1 100 words & fig.)

1929 621 .139 (.4), 625 .18 (.4) & 625 .27 (.
Railway Age, Section one, 28 December, p. 1483.
HARRIMAN (N. F.). — **Purchases and stores m thods of European railroads.** (1 800 words & fig.)

1929 656 .254 (.7
Railway age, Section one, 28 December, p. 1486.
Inter-communicating telephones for trains. (3 words & fig.)

1929 385 .586 (.7
Railway Age. No. 26, 28 December, section two, p. 15
Training apprentice repairmen. (2 100 words & fi

1929 621
Railway Age, No. 26, 28 December, section two, p. 15
LIVINGSTONE (C. J.), MARTIN (E. C.) and MA LEY (S. P.). — **Test carbon deposits in motor coa engines.** (1 100 words, 2 tables & fig.)

1929 656
Railway Age, No. 26, 28 December, section two, p. 15
Trucks from rebuilt motor coaches. (1 000 words fig.)

1930 385 .0 (.7
Railway Age, No. 1, 4 January, p. 9.
Railway executives optimistic regarding busine (7 700 words & fig.)

1930 656 .2 (.7
Railway Age, No. 1, 4 January, p. 17.
JOHNSON (A. B.). — **Quality development in 19** (2 200 words & fig.)

1930 621 .13 (.73), 625 .1 (.73) & 625 .2 (.7
Railway Age, No. 1, 4 January, p. 19.
HOWSON (E. T.). — **Railways will spe $ 1 200 000 000 for improvements in 1930.**

1930 385 .11 (.7
Railway Age, No. 1, 4 January, p. 23.
PARMELEE (J. H.). — **A review of railway op ations in 1929.** (12 300 words, 19 tables & fig.)

1930 656 .22 (.7
Railway Age, No. 1, 4 January, p. 35.
LAYNG (Ch.). — **Outstanding improvements in s vice characterize 1929.** (3 200 words & fig.)

1930 621 .13 (.73) & 625 .2 (.7
Railway Age, No. 1, 4 January, p. 39.
PECK (C. B.). — **The year's trend in equipment de lopment.** (1 500 words & fig.)

1930 621 .33 (.7
Railway Age, No. 1, 4 January, p. 41.
OEHLER (A. G.). — Status of electrification p grams. (1 200 words & fig.)

930 625 .17 (.73)
lway Age, No. 1, 4 January, p. 43.
ACHER (W. S.). — **Marked progress in maintece.** (1 900 words & fig.)

930 385 .11 (.71)
lway Age, No. 1, 4 January, p. 46.
YNE (J. G.). — **Great progress in Canada in 1929.** 00 words & fig.)

930 385 .11 (.73)
lway Age, No. 1, 4 January, p. 49.
RANCO (J. J.). — **Mexican lines improve efficiency.**) words, 2 tables & fig.)

930 385 .11 (.71 + .73) & 625 .1 (.71 + .73)
lway Age, No. 1, 4 January, p. 52.
OYD (G. E.). — **Railway construction activity conues unabated.** (10 300 words, 5 tables & fig.

930 385 .1 (.73)
lway Age, No. 1, 4 January, p. 63.
YNE (J. G.). — **Railway finances in 1929.** (3 000 rds, 8 tables & fig.)

930 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)
lway Age, No. 1, 4 January, p. 69.
TEEL (D. A.). — **Railway material and supply ts in 1929.**

930 621 .13 (.73) & 625 .2 (.73)
lway Age, No. 1, 4 January, p. 74.
YNE (J. G.). — **Railway equipment prices.** (900 rds, 3 tables & fig.)

930 625 .13 (.71 + .73)
lway Age, No. 1, 4 January, p. 78.
AFT (W. J.). — **Locomotives ordered in 1929.**

930 625 .24 (.71 + .73)
lway Age, No. 1, 4 January, p. 85.
RAEGER (F. W.). — **Freight car orders in 1929.** 0 words, 4 tables & fig.)

930 625 .23 (.71 + .73)
lway Age, No. 1, 4 January, p. 94.
UDSON (G. C.). — **Passenger car orders in 1929.** 0 words & 2 tables.)

930 621 .132.8 (.71 + .73)
lway Age, No. 1, 4 January, p. 99.
ECK (C. B.). — **The 1929 rail motor-car orders.** 0 words, 4 tables & fig.)

930 656 .1 (.73)
lway Age, No. 1, 4 January, p. 102.
MERY (J. C.). — **Motor transport looms larger in lway picture.** (3 000 words, 3 tables & fig.)

930 621 .9 (.73)
lway Age, No. 1, 4 January, p. 107.
ARGEST (W. J.). — **Shop tools and equipment ered during 1929.** (1 000 words, 1 table & fig.)

1930 656 .25 (.73)
Railway Age, No. 1, 4 January, p. 109.
DUNN (J. H.). — **Signaling construction increased during 1929.** (2 200 words, 7 tables & fig.)

1930 656 .25 (.73)
Railway Age, No. 1, 4 January, p. 116.
KENRICK (R. S.). — **Increase in communication plants.** (1 400 words, 5 tables & fig.)

1930 385 .11 (.3)
Railway Age, No. 1, 4 January, p. 119.
Railways abroad. (14 600 words & fig.)

1930 625 .143 (.73)
Railway Age, No. 2, 11 January, p. 137.
Three roads experiment with new type of track construction. (4 100 words & fig.)

1930 656 .254 (.73) & 656 .255 (.73)
Railway Age, No. 2, 11 January, p. 141.
SCHUBERT (J. H.). — **Trains operate by signal indication on the Paducah & Illinois.** (2 100 words & fig.)

1930 621 .132.5 (.73)
Railway Age, No. 2, 11 January, p. 144.
North Western gets heavier power (4-8-4). (1 100 words & fig.)

1930 656 .222 (.73)
Railway Age, No. 2, 11 January, p. 153.
American business reaps benefits from improved railway service. (6 100 words & fig.)

Railway Engineer. (London.)

1930 621 .132.8 (.42) & 621 .134.3 (.42)
Railway Engineer, January, p. 6.
Experimental 4-6-4 high-pressure compound locomotive, London & North Eastern Railway. (200 words & fig.)

1930 656 .25 (.42)
Railway Engineer, January, p. 7.
Extensive re-signalling on the Southern Railway. (2 600 words & fig.)

1930 621 .9 (.42)
Railway Engineer, January, p. 17.
A new locomotive frame plate slotting machine. (500 words & fig.)

1930 625 .233
Railway Engineer, January, p. 18.
COPPOCK (C.). — **Electric train-lighting equipment.** — IV. (2 300 words & fig.)

1930 621 .338 (.82)
Railway Engineer, January, p. 22.
New electric coaching stock for the central Argentine Railway. (1 000 words & fig.)

1930 656 .254 (.42)
Railway Engineer, January, p. 26.
The relay train describer. (2 900 words & fig.)

1930 625 .111 & 656 .21
Railway Engineer, January, p. 31.
HEARN (Sir Gordon). — **Roadside stations.** — I. (3 300 words & fig.)

1930 656 .255
Railway Engineer, January, p. 34.
Improved methods in the operation of single tracks. — IX. (1 300 words & fig.)

1930 621 .132.6
Railway Engineer, January, p. 36.
New heavy tank locomotives for the German Railways. (1 600 words & fig.)

1930 656 .253 (.42)
Railway Engineer, February, p. 50.
Re-signalling of London Bridge Station, Southern Railway. (1 400 words & fig.)

1930 621 .132.3 (.42) & 621 .132.8 (.42)
Railway Engineer, February, p. 55.
Experimental high-pressure compound locomotive, London & North Eastern Railway. (2 100 words & fig.)

1930 621 .132.3 (.42)
Railway Engineer, February, p. 59.
Experimental high-pressure locomotive, London Midland and Scottish Railway. (1 000 words & fig.)

1930 625 .111 & 656 .21
Railway Engineer, February, p. 61.
HEARN (Sir Gordon). — **Roadside Stations.** — II. (3 600 words & fig.)

1930 621 .9 (.42)
Railway Engineer, February, p. 64.
New machine tools for railway shops. (1 700 words & fig.)

1930 656 .211 (.42) & 725 .31 (.42)
Railway Engineer, February, p. 67.
Reconstruction of passenger station and yards, Clacton-on-Sea, London & North Eastern Railway. (2 000 words & fig.)

1930 625 .232 (.593)
Railway Engineer, February, p. 75.
New rolling-stock Royal State Railways of Siam. (2 000 words & fig.)

1930 625 .233
Railway Engineer, February, p. 78.
COPPOCK (C.). — **Electric train lighting equipment.** — V. (2 400 words & figs.)

1930 621 .132.8
Railway Engineer, February, p. 81.
Three types of locomotive : steam turbine, reciprocating engine, and Diesel-electric locomotive efficiencies. (3 300 words, 2 tables & fig.)

Railway Engineering and Maintenance. (Chicago.)

1930 625 .142.2 (.73)
Railway Engineering and Maintenance, Dec., p. 530.
BELCHER (R. S.). — **A billion crossties.** — What must be done to get a full return on what they cost (2 600 words & fig.)

1930 625 .123 (.73) & 721 .1 (.73)
Railway Engineering and Maintenance, Dec., p. 534.
Floating concrete pipes into place. (3 900 words & fig.)

1930 625 .17 (.73)
Railway Engineering and Maintenance, Dec., p. 538.
CHOATE (W. L.). — **Speeding up special trackwork renewal in a busy terminal.** (1 700 words & fig.)

1930 725 .33 (.73)
Railway Engineering and Maintenance, Dec., p. 541.
TANNER (R. A.). — **Concrete watertanks give excellent service.** (3 200 words & fig.)

1930 625 .18 (.73)
Railway Engineering and Maintenance, Dec., p. 545.
Making waste lumber pay dividends. (1 300 words & fig.)

1930 625 .175 (.73)
Railway Engineering and Maintenance, Section one, January, p. 4.
KNOWLES (C. R.). — **The track motor car.** (4 00 words & fig.)

1930 69
Railway Engineering and Maintenance, Section one, January, p. 9.
CARTHWRIGHT (F. P.). — **Much stronger building** at little extra cost (frame structures). (2 600 words & fig.)

1930 624 .174 (.71)
Railway Engineering and Maintenance, Section one, January, p. 13.
BROWN (C. B.). — **Fighting snow in a real snow country.** (3 700 words & fig.)

1930 625 .143 (.73)
Railway Engineering and Maintenance, Section one, January, p. 16.
Three roads try new type of track construction. (4 00 words & fig.)

Railway Gazette. (London.)

1930 656 .254 (.42) & 656 .255 (.42)
Railway Gazette, No. 2, 10 January, p. 49.
Train and traffic control on the London & North Eastern Railway. (1 100 words.)

1930 656 .22 (.42)
Railway Gazette, No. 2, 10 January, p. 50.
Features of railway operation. (1 300 words.)

1930 385 .4 (.68)
ilway Gazette, No. 2, 10 January, p. 53.
The new « System » organisation in South Africa. 100 words & fig.)

1930 385. (09 .1 (.88)
ilway Gazette, No. 2, 10 January, p. 56.
Railways in British Guiana. (900 words, 1 map & .)

1930 656 .255
ilway Gazette, No. 2, 10 January, p. 59.
The operation of single lines of railway. — XXVI. 800 words & fig.)

1930 625 .245 (.55)
ilway Gazette, No. 3, 17 January, p. 80.
80-ton articulated bogie wagon for service in Persia. 0 words & fig.)

1930 625 .13 (.42)
ilway Gazette, No. 3, 17 January, p. 83.
WHITLEY (H. S. B.). — An interesting bridge construction on the Great Western Railway (Gr. Br.).

1930 656 .255 (.42)
ilway Gazette, No. 3, 17 January, p. 84.
The operation on single lines of railway. — XXVII. 500 words.)

1930 385 .52 (.3)
ilway Gazette, No. 3, 17 January, p. 86.
Railway salaries. (500 words & 2 tables.)

1930 656 .1 (.42)
ilway Gazette, No. 3, 17 January, p. 88.
Country lorry services : Great Western Railway r.-Br.). (1 300 words & fig.)

1930 385 .586 (.54)
ilway Gazette, No. 4, 24 January, p. 121.
Railway staff training in India. (2 800 words & fig.)

1930 621 .134.2 (.42)
ilway Gazette, No. 4, 24 January, p. 127.
Reconstructed four-cylinder express locomotive, Lon- n & North Eastern Railway. (1 000 words & fig.)

1930 656 .255
ilway Gazette, No. 4, 24 January, p. 129.
The operation of single lines of railway. (600 words fig.)

1930 621 .132.7 (.68)
ilway Gazette, No. 4, 24 January, p. 128.
Shunting locomotives for Rhodesia. (400 words & fig.)

1930 656 .255
ilway Gazette, No. 4, 24 January, p. 129.
The operation of single lines of railway. — XXVIII. 000 words & fig.)

1930 656 .1 (.42) & 656 .2 (.42)
ilway Gazette, No. 4, 24 January, p. 130.
British railway arrangements with omnibus under- kings. (800 words.)

1930 625 .234 (.42)
Railway Gazette, No. 4, 24 January, p. 132.
Ventilation of railway coaches with cooled and filtered air. (700 words.)

Railway Magazine. (London.)

1930 656 .222.1 (.42)
Railway Magazine, February, p. 89.
ALLEN (C. J.). — British locomotive practice and performance. (4 200 words, 1 table & fig.)

Railway Mechanical Engineer. (New York.)

1929 621 .138.5 (.73)
Railway Mechanical Engineer, December, p. 712.
North Western mechanical forces stabilized (Practical application of monthly budget). (3 000 words & fig.)

1929 621 .132.3 (.73) & 621 .132.5 (.73)
Railway Mechanical Engineer, December, p. 717.
4-8-4 type locomotives for the Rock Island. (800 words, 2 tables & fig.)

1929 621 .132.1 (.73)
Railway Mechanical Engineer, December, p. 725.
Examples of recent passenger and fast-freight locomotives of the 4-8-2 type. (1 table.)

1929 621 .138.5 (.73)
Railway Mechanical Engineer, December, p. 726.
Mc GOWAN (W. L.). — How the Antlantic Coast Line repairs locomotives at Tampa. — Part I. (3 400 words & fig.)

1930 669 .1 (.73)
Railway Mechanical Engineer, December, p. 739.
BARR (Dr. William M.). — Alloy steels in locomotive construction. (3 300 words & fig.)

1929 625 .26 (.73)
Railway Mechanical Engineer, December, p. 743.
Pullman builds modern freight shops at Bessemer, Ala. (3 200 words & fig.)

1929 625 .26 (.73)
Railway Mechanical Engineer, December, p. 748.
Present day demands of the repair track. (2 100 words & fig.)

1930 656 .26 (.73)
Railway Mechanical Engineer, January, p. 4.
Inspecting the main tracker for long runs. (2 700 words & fig.)

1930 621 .133.8 (.73)
Railway Mechanical Engineer, January, p. 7.
Air sand elevator with gravity delivery. (300 words & fig.)

1930 621 .132.3 (.73) & 621 .132.5 (.73)
Railway Mechanical Engineer, January, p. 8.
Heavy 4-8-4 locomotives for the North Western. (1 500 words, 1 table & fig.)

1930 621 .86 (.73)
Railway Mechanical Engineer, January, p. 12.
High-speed wheel handler. (500 words & fig.)

1930 621 .138.5 (.73)
Railway Mechanical Engineer, January, p. 13.
Mc GOWAN (W. L.). — **How the Atlantic Coast Line repairs locomotives.** — Part II. (2 500 words & fig.)

1930 625 .26 (.73)
Railway Mechanical Engineer, January, p. 19.
Shopping freight cars on a life expectancy basis. (2 400 words, 1 table & fig.)

1930 621 .137.2 (.73) & 656 .222 (.73)
Railway Mechanical Engineer, January, p. 23.
ARMSTRONG (G. W.). — **Road tests of the auxiliary locomotive.** (2 000 words, 3 tables & fig.)

1930 621 .138.5 (.73) & 625 .26 (.73)
Railway Mechanical Engineer, January, p. 28.
WHITFIELD (E. O.). — **Maintaining rail motor cars** on the New Haven. (2 500 words, 12 tables & fig.)

1930 669 .1
Railway Mechanical Engineer, January, p. 37.
Alloy steels for railroad service (Discussion at annual meeting of A. S. M. E.). (4 000 words & fig.)

1930 621 .118 (.73)
Railway Mechanical Engineer, January, p. 41.
Annual report of Bureau of Locomotive Inspection. (800 words, 1 table & fig.)

Railway Signaling. (Chicago.)

1929 656 .257 (.73)
Railway Signaling, December, p. 437.
PATTERSON (A. J.). — **Hocking Valley builds electric interlocker,** with a small battery. (2 500 words & fig.)

1929 656 .255 (.73)
Railway Signaling, December, p. 441.
LEWIS (H. W.). — **Signal direct trains.** (1 200 words & fig.)

1929 625 .258 (.73)
Railway Signaling, December, p. 447.
Big Four installs retarders at Sharonville Yard. (1 200 words, 2 tables & fig.)

1929 656 .255 (.73)
Railway Signaling, December, p. 452.
Either direction signaling solves operation problem for D. & R. G. W. on a mountain grade. (1 500 words & fig.)

1929 656 .25 (0 (.73
Railway Signaling, December, p. 454.
Interstate Commerce Commission reports on **signalin**g (2 300 words & 1 table.)

1929 656 .253 (.54
Railway Signaling, December, p. 456.
COX (H. E.). — **Color-light signals installed on India** railway. (3 500 words & fig.)

1930 656 .25 (.73
Railway Signaling, January, p. 1.
Signaling construction increased during 1929. (2 70 words, 16 tables & fig.)

1930 656 .254 (.73) & 656 .255 (.73
Railway Signaling, January, p. 13.
SCHUBERT (J. H.). — **Signal indications direc trains on the Paducah & Illinois.** (4 700 words & fig.)

1930 656 .254 (.73) & 656 .255 (.73
Railway Signaling, January, p. 20.
Canadian Pacific installs **centralized traffic contr** to solve operating problem. (2 200 words & fig.)

1930 625 .258 (.73
Railway Signaling, January, p. 24.
Car retarders facilitate car dumper operations. (30 words & fig.)

In Spanish.

Gaceta de los Caminos de hierro. (Madrid.)

1930 621 .132.8 (.73
Gac. de los Cam. de Hierro, n° 3610, 1° de Febrero, p. 3
Automotrices de gran potencia construidas por l Compañia « Chicago Rock Island and Pacific Railroad » (1 100 palabras.)

Ingenieria y Construccion. (Madrid.)

1930 625 .1 (.460
Ingenieria y Construccion, Enero, p. 1.
Los obras de la Compañia del Norte en Barcelona (5 100 palabras & fig.)

1930 621 .33 (.460
Ingenieria y Construccion, Enero, p. 11 y Febrero, p. 6
GIBERT y SALINAS (A.). — **Continua o monofá sica? En torno al sistema de corriente más adecuad para la electrificación de los ferrocarriles españole** (5 700 palabras.)

Revista de Obras Públicas. (Madrid.)

1930 621 .33 (.460
Revista de Obras Publicas, n° 2, 15 de Enero, p. 31
n° 3, 1° de Febrero, p. 45.
SANCHEZ-CUERVO (L.). — **La electrificación de l ferrocarriles españoles.** (4 300 palabras.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1929 621 .33

nnali dei Lavori pubblici, dicembre, p. 1064.

BARAVELLI (P.). — A proposito di una **determina-one delle caratteristiche fondamentali per ferrovie ettriche.** (11 200 parole, 4 tavole.) (Continuazione e ne.)

L'Ingegnere. (Roma.)

1929 656 .1 & 656 .2

'Ingegnere, dicembre, p. 766.

VEZZANI (F.). — **Strade, autostrade e ferrovie.** conomia e legislazione (continuazione e fine). (7 500 arole.)

1930 625 .5

'Ingegnere, dicembre, p. 775.

ANASTASI (A.). — **Di alcuni punti del calcolo della nfigurazione delle funicolari aeree.** (2 800 parole fig.)

1930 691

'Ingegnere, gennaio, p. 14.

JODI (C. F.). — Calcoli di **resistenza per cemento rmato** per qualunque valore del rapporto **N.** (700 pa-le & fig.)

1930 388 (.45)

'Ingegnere, gennaio, p. 17.

DE VITA (R.). — **La riforma dei servizi di trasporto llettivo in Roma.** (5 000 parole & fig.)

Notiziario Tecnico. (Firenze.)

1930 624 .32 (.45)

otiziario Tecnico, febbraio, p. 45.

Nuovo ponte sul fiume Sieve al km. 20 + 916 della nea Borgo S. Lorenzo-Pontassieve fra le stazioni di ntea Londa e di Rufina. (600 parole & fig.)

1930 62. (01

otiziario Tecnico, febbraio, p. 50.

La resilienza. — B. (2 500 parole & fig.) (Continua.)

---

ivista delle comunicazioni ferroviarie. (Roma.)

1930 656 .1 (.43) & 656 .2 (.43)

ista delle comun. ferroviarie, n° 2, 15 gennaio, p. 11.

L'esperienza delle ferrovie tedesche in materia di con-rrenza automobilistica. (700 parole.)

1930 385. (09

Rivista delle commun. ferroviarie, n° 3, 1° febbraio, p. 14.

MALTESE (Dott. Salvatore). — **Fatti e dati caratteristici sui primi tempi d'esercizio delle ferrovie.** (2 200 parole.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1929 621 .33 (.45)

Rivista tecnica delle ferrovie italiane, dicembre, p. 233.

CASSINIS (R.). — **La sistemazione degli impianti di trazione in seguito all' apertura della linea** Cuneo-Ventimiglia. (4 300 parole.)

1929 385. (09 (436 + 45)

Rivista tecnica delle ferrovie italiane, dicembre, p. 242.

MALTESE (S.). — **Le grandi opere ferroviarie; la costruzione della Ferrovia del Semmering.** (6 600 parole.)

1929 625 .4 (.45)

Rivista tecnica delle ferrovie italiane, dicembre, p. 254.

VALLECHI (U.). — **Verifiche di stabilita' dei rivestimenti di galleria** per le Ferrovie Metropolitane di Roma. (4 300 parole.) (Continuazione.)

1929 016 .62

Rivista tecnica delle ferrovie italiane, dicembre, p. 267.

GIOVENE (N.). — **L'arte dell' ingegnere nella nuova classificazione decimale.** (800 parole & 1 tavola.)

1930 625 .13 (.45)

Rivista tecnica delle ferrovie italiane, gennaio, p. 1.

GOTELLI (R.). — **Raddoppio Manarola-Riomaggiore.** (5 900 parole & fig.)

1930 625 .26

Rivista tecnica delle ferrovie italiane, gennaio, p. 11.

D'ARBELA (A.). — **Alcuni criteri per la possibile applicazione di un sistema di tolleranze nelle riparazioni di materiale ferroviario.** (6 300 parole, 1 tavola & fig.)

In Dutch.

De Ingenieur. (Den Haag.)

1930 385 (01 (.57 + .58)

De Ingenieur, N^r 6, 7 Februari, p. 1.

SCHERMERHORN (D.). — **Over den bouw van den Turkestan-Siberischen Spoorweg.** (6 900 woorden, 3 tafereelen & fig.)

De Locomotief. (Amsterdam.)

1930 669 .1

De Locomotief, N^r 5, 1 Maart, p. 34.

De thermische behandeling van spoorstaven. (2 100 woorden, 2 tafereelen & fig.)

Spoor- en Tramwegen. (Utrecht.)

1930 **697**

Spoor- en Tramwegen, N^r 2, 21 Januari, p. 34 & N^r 3, 4 Februari, p. 70.

BLEULAND VAN OORDT (M. L.). — **Verwarming van Spoorweggebouwen.** (2 300 woorden & fig.)

1930 **625 .245 (.92)**

Spoor- en Tramwegen, N^r 2, Januari, p. 36.

DE GRUYTER (P.). — **Het meetrijtuig der Nederlandsch-Indische Staatspoorwegen.** (4 000 woorden & fig.)

1930 **621 .132.8 (.492)**

Spoor- en Tramwegen, N^r 2, 21 Januari, p. 40.

BOLLEMAN KYLSTRA (E.). — **De nieuwe benzinemotorrijtuigen** der Nederlandsche Spoorwegen. (1 000 woorden & fig.)

1930 **621 .132.8 (.492)**

Spoor- en Tramwegen, N^r 2, 21 Januari, p. 44.

LABRYN (P.). — Nieuwe **locomotoren** voor de Nederlandsche Spoorwegen. (1 800 woorden & fig.)

1930 **621 .132.8 (.92)**

Spoor- en Tramwegen, N^r 3, 4 Februari, p. 73.

JANSEN (D.). — **De tandradlocomotieven** der Staatsspoorwegen ter Sumatra's Westkust in het algemeen en de oEo tandradlocomotief in het bijzonder. (1 600 woorden & fig.) (Wordt vervolgt.)

In Polish.

INŻYNIER KOLEJOWY. (Warszawa).

1930 **656 .232**

Inzynier Kolejowy, Styeznia, str. 2.

KRZYZANOWSKI (A.). — Zarys ogólnej teorji kosztów wtasnych przewozów kolejowych. (7 200 slowa & rys.)

1930 **621 .131.3**

Inzynier Kolejowy, Stycznia, str. 23.

ZABTOCKI (M.). — Przyczynek do metod badania parowozów. (540 slowa & rys.)

In Portuguese.

Boletim do Instituto de Engenharia. (S. Páulo.) (Brasil.)

1929 **656 .23**

Boletim do Instituto de Engenharia, Dezembro, p. 409.

DE CASTRO BARBOSA (J.). — **Da organizaçâo do trafego ferroviario.** (5 600 palavras, 9 cuadros & fig.) (Continuaçâo e fim.)

1929 **625 .143.3**

Boletim do Instituto de Engenharia, Dezembro, p. 438.

DA COSTA PINTO (J.-B.). — **Segregaçôes negativas como causa de fracturas de trilhos.** (1 500 palavras & fig.)

1930 **315 .1 (.43) & 385 .4 (.43)**

Boletim do Instituto de Engenharia, Janeiro, p. 24.

DA COSTA PINTO (J. B.). — A Deutsche Reichsbahn Gesellschaft; **sua organisaçâo financeira e administrativa.** (7 700 palavras.)

Revista das Estradas de Ferro. (Rio de Janeiro.)

1930 **621 .335 (.44)**

Revista das Estradas de ferro, n° 107, 30 de Dez., p. 561.

As locomotivas de alta velocidade da Companhia de Orléans. (900 palavras & fig.) (Continúa.)

1930 **385 .113 (.81)**

Revista das Estradas de ferro, n° 107, 30 de Dez., p. 567.

ZANDER (R. F.). — **Relatorio do anno 1928 da Estrada de Ferro Central do Brasil.** (7 400 palavras, 5 cuadros.)

9150. — Publisher : M. Weissenbruch Co., Ltd., Printer to the King, 49, rue du Poinçon, Brussels.

MONTHLY BIBLIOGRAPHY OF RAILWAYS [1].

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016 .385. (02]

I. — BOOKS.

In French.

930 621 .94

AM (I. P.).

anuel du tourneur mécanicien, 9e édition.

aris (6e), Dunod, 92, rue Bonaparte. Un volume × 18 cm.), 102 pages, 43 fig. (Prix : fr. 10.50.)

930 388 (.44)

TTE (L.).

es chemins de fer urbains parisiens. — Historique. Modalités de la concession. — Construction de l'infructure.

aris (6e), J. B. Baillière & fils, 19, rue Hautefeuille. volume in-8°, 525 pages avec 248 figures. (Prix : francs.)

930 656 .23

CH (R.).

uestions de chemins de fer (Etudes commerciales).

aris, Librairie de l'Enseignement technique, Léon olles. 65 pages. (Prix : 5 francs.)

930 721 .9

MBRE SYNDICALE DES CONSTRUCTEURS EN CIMENT ARME DE FRANCE.

èglement sur les constructions en béton armé.

aris (6e), Gauthier-Villars & Cie, imprimeurs-édis, 55, quai des Grands-Augustins. Un volume in-8° × 16 cm.) de 46 pages. (Prix : 8 francs.)

930 621

MPLY (R.), ingénieur mécanicien.

mment on devient ajusteur et monteur mécanicien.

ris (6e), Librairie Centrale des Sciences, Desforges rdot & Cie, 27 et 29, quai des Grands-Augustins. volume in-8°, 266 pages, 295 fig. (Prix : 25 francs.)

30 531. (02

OMAN VARGHA, ingénieur.

de-calcul graphique pour la mécanique générale.

ris (6e), Librairie polytechnique Ch. Béranger, ue des Saints-Pères; et Liége, 1, quai de la Grande-Bretagne. Un atlas (30 × 40 cm.) de 20 planches. (Prix: 82 francs.)

1930 33 (02 & 656. (02

COLSON (C.).

Les travaux publics et les transports.

Paris (6e), Gauthier-Villars & Cie, 55, quai des Grands-Augustins. Un volume (25 × 16 cm.), 576 pages. (Prix: 35 francs.)

1930 62. (01

FÖPPL (A.), professeur.

Résistance des matériaux et éléments de la théorie mathématique de l'élasticité, traduit de l'allemand par E. Hahn, ingénieur.

Paris (6e), Gauthier-Villars & Cie, 55, quai des Grands-Augustins. Un volume in-8° (25 × 16 cm.) de 488 pages, avec figures. (Prix : 40 francs.)

1930 621 .3

LAFFARGUE (J.) et JUMAU (L.).

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Paris (6e), Gauthier-Villars & Cie, 55, quai des Grands-Augustins. Un volume in-8°, de 954 pages, 849 figures et 5 planches en couleurs. (Prix : 75 francs.)

1930 691

MAGNEL (G.), ingénieur.

Pratique du calcul du béton armé, 3e partie : **Calcul des arcs.**

Gand, Editeur : Van Rysselberghe et Rombaut, place d'Armes, 1. 2 volumes brochés, 354 pages de texte, 95 figures, 12 planches hors texte et nombreux graphiques. (Prix : 140 francs.)

1930 621 .11

MONTUPET (A.).

Cours pratique de chaudronnerie. Chaudronnerie en fer. 8e édition.

Paris (6e), Librairie polytechnique Ch. Béranger, 15, rue des Saints-Pères; Liége, 1, quai de la Grande-Bretagne. Un volume in-8° carré (14 × 22 cm.) de 161 pages, avec figures dans le texte et 43 planches hors texte. (Prix : broché, 18 francs.)

[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly the Office Bibliographique International. of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by ISSENBRUCH in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1930 621 .112
MUNZINGER (F.).
La vapeur à très haute pression. Traduction d'après l'allemand, complétée et mise à jour, par A. SCHUBERT, ingénieur E. C. P.
Paris (6e), Dunod, 92, rue Bonaparte. Un volume (16 × 25 cm.), XVI-275 pages, 171 figures. (Prix : relié, 71 francs.)

1930 621 .87
NACHTERGAL (A.), ingénieur.
Calcul et construction des grues, 2e édition.
Paris (6e), Librairie polytechnique Ch. Béranger, 15, rue des Saints-Pères; Liége, 1, quai de la Grande-Bretagne. Un volume in-8° raisin (16 × 25 cm.) de 358 pages, avec 372 figures dans le texte. (Prix : 85 francs.)

1930 691
SIMÉON (L.).
Le calcul du béton armé à la portée de tous.
Paris (5e), H. Vial, rue Saint-Jacques, 40. Un volume in-8°, 320 pages et un atlas de 11 planches. (Prix : 125 francs.)

1930 621 .83
SOBECK (A.), ingénieur A. M.
Table pour la détermination directe des **combinaisons d'engrenages.** Organisation cinématique des mécanismes. Montages sur machines-outils.
Paris (6e), Librairie polytechnique Ch. Béranger, 15, rue des Saints-Pères; Liége, 1, quai de la Grande-Bretagne. Un volume in-8° raisin (16 × 25 cm.), de 144 pages avec de nombreux tableaux. (Prix : relié, 65 francs.)

1930 347 .763 .4
THÉVENEZ (R.).
Législation des chemins de fer.
Paris, Rousseau & Cie, 2 volumes in-8° de 1 200 pages. (Prix : 120 francs.)

In German.

1929 621
BARTH (Fr.).
Die Maschinenelemente.
Berlin & Leipzig, Walter de Gruyter & Co. (Preis : 1.80 Rm.)

1930 656 .21
BLUM (O.).
Personen- und Güterbahnhöfe.
Leipzig, Verlag von Johann Ambrosius Barth. Gr. 8°, VI-273 Seiten mit 337 Textabb. (Preis : 28.50 Rm.)

1930 656 .1 (.43) & 656 .2 (.43)
Eisenbahn und Kraftwagen. Tatsachen u. Gedanken zur Neugestalltung des deutschen Verkehrswesens.
Leipzig, Verlag von Johann Ambrosius Barth. 4°, VIII-98 Seiten. (Preis : 10 Rm.)

1930
GRAF (O.).
Der Aufbau des Mörtels und des Betons.
Leipzig, Verlag von Johann Ambrosius Barth. 3. N bearbeitete Auflage. Gr. 8°, VIII-151 Seiten mit Textabb. (Preis : 16 Rm.)

1930
GRAF (O.).
Versuche über des Verhalten von Zementmörtel heissem Wasser. Bericht.
Leipzig, Verlag von Johann Ambrosius Barth. 4°, 27 Seiten mit 36 Textabb. u. 3 Zsstellgn. (Preis : 4 Rm.)

1930 385 .1 (.4
HAUSMANN.
Die Beziehungen zwischen der Deutschen Reichsbal Gesellschaft und der Deutschen Verkehrs-Kredit-Ba
Nürnberg, Eisenbahnkunde.

1929
HENKEL (O.), Ingenieur.
Grundzüge des Eisenbaues.
Leipzig und Berlin, B. G. Teubner, 224 Seiten u 511 Abbildungen. (Preis : 6.60 Rm.)

1930 625. (
KOCHENRATH (W.).
Grundzüge des Eisenbahnbaues. Teil 1: Linienführu Unter- u. Oberbau, Schutz- u. Nebenanlagen auf fre Strecke.
Leipzig, Verlag von Johann Ambrosius Barth. 3. n bearbeitete Auflage. 8°, 259 Seiten mit rund Textabb., 11 grösseren Tabellen u. 5 Tafel-Zeichnung (Preis : 5.70 Rm.)

1929 385. (
LOHSE (F.).
Ein Jahrhundert Eisenbahn.
Leipzig, Verlag Johann Ambrosius Barth. Format D A-5, 55 Seiten mit 2 Bilderbogen u. zahlr. Textzei nungen. (Preis : 1.85 Rm.)

In English.

1930 347 .763 .4 (.7
Bills introduced and laws enacted relating to railw legislation, State Legislatures, Sessions of 1929. Co piled by Committee on Relations of Railway Operat to Legislation.
New York and Chicago. Published by American R way Association, 257 pages.

1930 51 (08 & 656 .222
BIRD (Cecil H.).
Speed table.
Derby : C. H. Bird, New Road, Ambergate. Ta printed on No. 1 cartridge paper and folded to fit se stiff cloth cover. (Price : 10 sh. 6 d.)

930 621 .139. (02, 625 .18 (02 & 625 .27 (02
DY (George S.).
aterials Handbook.
ew York, Mc Graw-Hill Book Company, Inc., 370
nth avenue. Bound in leather (4 × 7 in.), 428 pages.
ce : $ 4.)

930 01 (.42)
itish Standard Publications Index.
ndon : Published by British Standards Association
blications Department), 28 Victoria Street S. W. 1.
ce : 1 sh. 2 d. post free.)

930 625 .13 (.42 + .44)
annel Tunnel Committee Report.
ndon. Published by His Majesty's Stationary Office,
stral House, Kingsway. — 111 pages, plans, map
graph. (Price : 3 sh. net.)

930 656 .2 (.54)
U (C. L.).
ie principles of transportation.
anghai (China). 1 vol. of 278 pages. Published by
Commercial Press.

930 621 .33 & 669 .3
PER AND BRASS RESEARCH ASSOCIATION.
survey of the uses of copper and its alloys in the
rification of steam railroads.
ew York City. — Published by Copper and Brass
arch Association. 119 pages. Apply.

930 625 .214 & 669
SE (W. M.).
earing metals and bearings. (American Chemical
ety Monograph Series.)
ew York (U. S. A.). — The Chemical Catalog Com-
. One vol., 383 pages. (Price : $ 7.00.)

930 016 .385 .3 (.73)
scriptive list of Bureau Publications, 1 March 1930.
ashington D. C. — Published by Bureau of Railway
nomics. 8 pages. (Apply.)

930 621 .33
ER (A. T.).
ectric traction.
ndon, Sir Isaac Pitman and Sons, Ltd. Second edi-
(Price : 25 sh.)

930 385
NG (A. J.).
siness and the Railroads.
mphlet of 28 pages. Available from Author, Wichita,
sas (U. S. A.). (Price : 20 cents per copy in lots
to 100.)

930 625 .143 .3 (.73)
EMAN, Jr. (J. R.) and SOLAKIAN (H. N.).
fect of service on endurance properties of steel
ashington D. C. — Published by U. S. Government
ting Office. One volume. (Price : 20 cents.)

1930 656 .29
HADLEY (Edward S.).
Railway thefts. Second edition.
London : 62, Grove Avenue, W. 7. 1 vol., 32 pages. (Price : 6 d.)

1930 385. (09 (.67)
HAMMOND (F. D.), Brig.-General, C. B. E., D. S. O.
Report on the railway system of Tanganyika Territory.
London S. W. 1 : Crown Agents for the Colonies, 4, Millbank. 99 pp. (Price : 5 sh.)

1930 625 .142 .2 & 691
KAMESAM (S.), B. E., M. E.
Antiseptic treatment of Pinus Longifolica (chir) for railway sleepers.
Calcutta : Government Printing Branch. Technical Paper No. 271. 31 pp. and plates. (Price : 3 sh. 6 d.)

1929 526 (.54)
KENNETH MASON (Major), M. C., R. E., Survey of India.
The stereographic Survey of the Shaksgam, and
HINKS (Arthur R.), C. B. E., F. R. S., Sec. R. G. S.
An attempt to describe Mr. Wild's stereo-plotting machine — the Autograph.
Calcutta. Government of India Central Publication Branch. Technical paper No. 272. 44 pages with plates. (Price : Rs. 1-4-0 or 2 sh. 6 d.)

1930 656 .231
LORENZ (M. O.).
Commodity values and freight rates.
Washington D. C. — Published by Bureau of Statistics, Interstate Commerce Commission. One pamphlet, 10 p. (Apply.)

1930 385. (02
MORRIS (Ray) and HOOPER (Wm. E.).
Railroad administration.
London W. C. 2 : D. Appleton & Co., 34, Bedford Street, Covent Garden (8 1/2 × 5 1/2 × 1 1/4 in.); 211 pp. (Price : 15 sh. net.)

1930 669
NAISH (W. A.) & CLENNELL (J. E.).
Select methods of metallurgical analysis.
London, Chapman and Hall, Limited. (Price : 30 sh. net.)

1930 385 .11 (.73)
PARMELEE (J. H.).
A review of Railway Operations.
Washington D. C. — Published by Bureau of Railway Economics and issued as Bulletin 51. 40 pages. (Apply.)

1930 621 .135. (01
POUNDER (C. C.).
The balancing of engines.
London, the Draughtsman Publishing Company, Ltd., 96, St. George's-square. (Price : 4 sh. net.)

1930 385. (09 (.942) & 659 (.942)

Railway Facts. (Information concerning the railways of South Australia.)

Published by the South Australian Government Railways.

1930 385. (09 (.460)

« Railway Gazette » special Spanish Railway number.

London S. W. 1 : « The Railway Gazette », 33, Tothill Street, Westminster. 116 pp., 144 half-tone illus. and a map. (Price : 2 sh. 6 d.)

1929 656 .1 (.68) & 656 .2 (.68)

Report of the **Road Motor Competition** Commission (Union of South Africa).

Capetown. Published by Cape Times Limited. 1 vol. (13 × 8 inches), of 68 pages. (Price : 3 sh.)

1929 625 .111. (02

SEARLES.

Field Engineering. Twentieth edition, revised and enlarged. By H. C. Ives.

New York : John Wiley & Sons. — London : Chapman & Hall Limited. Two volumes in one (7 × 4 1/4 inches) of 726 pages. (Price, limp leather : 20 sh. net.)

1930 385 .3 (.42) & 656 .23 (.42)

SPARKE (H. C.).

An outline of the **State Control of English railway rates and facilities.**

Calcutta. Chuckervertty, Chatterjee & Co. Ltd. 1 vol. (7 1/4 × 5 inches) with 105 pages. (Price : 3 sh. 9 d.)

1930 721 .9

Standard specifications for steel structures for building (second edition).

Ottawa. Canadian Engineering Standards Association. One pamphlet (6 × 9 inches) of 39 pages.

1930 313 .385 (.73)

Statistics of Railways in the United States, 1928. Compiled by Bureau of Statistics, Interstate Commerce Commission.

Washington D. C. — Published by U. S. Government Printing Office. 272 pages. (Price : $ 1.40.)

1930 385. (08 (.6

Tanganyika Railways and Marine annual Report, ye ended 31 March 1929.

London. Published by the Crown Agents for the Col nies, 4, Millbank, London, S. W. 1. (Price : 5 sh.)

1930 385. (0

The **Analysis of Commercial lubricating oils by ph sical methods.**

London. His Majesty's Stationary Office, Adastr House, Kingsway W. C. 2. (Price : 1 sh. 9 d. net.)

1930 385. (02 (.4

The Railway Year Book for 1930.

London, S. W. 1. : Published at the offices of T Railway Magazine, by the Railway Publishing Co pany Ltd., 33, Tothill Street. (8 3/4 × 5 1/2 in 375 pp. (Price : 5 sh. net.)

1930 385. (

The Universal Directory of Railway Officials, 193

London, S. W. 1 : The Directory Publishing Co. Lt 33, Tothill Street, Westminster. (8 1/2 × 5 1/2 in. 390 pp. (Price : 20 sh. net.)

1929 625 .13 (.54

THOMSON (R. O. C.), M. C., A. M. I. C. E., Executi Engineer North Western Railway (India).

A practical note on **tunnelling** in shale and limeston

Calcutta. Government of India Central Publicatio Branch. Technical paper No. 274. 23 pages with plate (Price : Re. 1 or 1 sh. 9 d.)

In Italian.

1930 62

ALBENGA (G.).

Lezioni di Ponti.

Torino, U. T. E. T. Vol. I., 218 pagine & fig. (Prezzo 30 Lires.)

1930 69

PUGNALI (A.), Ingénieur.

La pratica del cemento armato.

Milano, Libreria editrice politecnica de Cesare Tan burini fu Camillo. Volume primo. Parte generale. 2 pagine con 474 figure.

[016 .385. (05]

II. — PERIODICALS.

In French.

Arts et Métiers. (Paris.)

1930 624 .2

Arts et Métiers, avril, p. 176.

MARCOTTE (E.). — **Effort tranchant sur les poutres.** (700 mots & fig.)

1930 669

Arts et Métiers, mai, p. 210.

MARCOTTE (E.). — **Nouvelles recherches sur les métaux.** (2 500 mots & fig.)

Annales des Ponts et Chaussées. (Paris.)

1929 721

Annales des ponts et chauss., novembre-décembre, p. 20

MABILLEAU. — **Procédés pour le calcul rapide d pièces en béton armé.** (6 000 mots & fig.)

1929 624 .

Annales des ponts et chauss., novembre-décembre, p. 2

LAMORRE. — **Construction d'un pont en béton ar** de 26 m. 60 d'ouverture, sur l'oued Ouzière, au Mar oriental. (4 000 mots, 1 tableau & fig.)

930 721 .9
ales des ponts et chauss., janvier-février, p. 14.
ASSON (H.). — Calcul des **conduites en béton armé.**
00 mots.)

930 721 .9 (.493)
ales des ponts et chauss., janvier-février, p. 65.
SSOCIATION BELGE DE STANDARDISATION. — **tructions relatives aux ouvrages en béton.** (5 000
s & fig.)

Bulletin de la Société d'encouragement pour l'industrie nationale. (Paris.)

930 669
l. de la Soc. d'encour. pour l'ind. nat., févr., p. 117.
ICOLAU (P.). — Quelques progrès récents des **hodes de contrôle des produits métallurgiques.**
800 mots & fig.)

930 016
l. de la Soc. d'encour. pour l'ind. nat., mars, p. 193.
AJORELLE (J.). — Deux réalisations dans le do-ne de la documentation technique et économique : fiches documentaires et les cartes industrielles de la iété de documentation industrielle. (5 600 mots &
)

Bulletin de la Société des Ingénieurs civils de France. (Paris.)

929 621 .33 & 621 .35
l. de la Soc. des ing. civ. de France, sept.-oct., p. 920.
HALUMEAU (C.). — Contribution à la **traction trique par accumulateurs.** (15 000 mots, 1 tableau ig.)

lletin de l'Union internationale des chemins de fer. (Paris.)

930 621 .138 & 625 .26
l. de l'Union intern. des ch. de fer, fév.-mars, p. 39.
ÜHNE. — Importance des dépenses pour la **répara-n et l'entretien du parc de matériel roulant** dans nomie de la gestion des véhicules. (1 500 mots & ab.)

930 385 .113 (.44)
l. de l'Union intern. des ch. de fer, fév.-mars, p. 42.
es chemins de fer exploités par l'Etat français pen-t l'exercice 1928. (6 000 mots.)

930 385 .113 (.493)
l. de l'Union intern. des ch. de fer, fév.-mars, p. 59.
es **résultats d'exploitation** de la Société nationale chemins de fer belges pour l'exercice 1928. (2 400 s.)

1930 385 .113 (.43)
Bull. de l'Union intern. des ch. de fer, fév.-mars, p. 71.
Bull. de l'Union intern. des ch. de fer, avril, p. 143.
LEVERVE (G.). — **Rapport du Commissaire des chemins de fer allemands** à la Commission des Réparations sur la cinquième année d'application du plan des experts. 1er septembre 1928-31 août 1929. (19 000 mots.)

1930 625 .232. (06
Bull. de l'Union intern. des ch. de fer, avril, p. 119.
La Compagnie internationale des wagons-lits et des grands express européens. (3 600 mots.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1930 313 .385 (.485)
Bull. des transp. intern. par ch. de fer, mars, p. 192.
Les chemins de fer suédois en 1928. — Statistique. (1 600 mots.)

1930 313 .385 (.43)
Bull. des transp. intern. par ch. de fer, avril, p. 235.
Statistique des chemins de fer allemands pour l'exercice 1928. (1 600 mots.)

1930 313 .385 (.439)
Bull. des transp. intern. par ch. de fer, mai, p. 278.
Statistique des chemins de fer royaux de l'Etat hongrois pour l'exercice 1928-1929. (800 mots.)

Bulletin Technique de la Suisse Romande. (Vevey.)

1930 623 & 624
Bull. technique de la Suisse Romande, n° 6, 22 mars, p. 65; n° 7, 5 avril, p. 77; n° 8, 19 avril, p. 89; n° 9, 3 mai, p. 105.
BUHLER (A.). — **Ponts de guerre.** (4 000 mots, tableaux & fig.)

1930 621 .33 (.494)
Bull. technique de la Suisse Romande, n° 7, 5 avril, p. 85 et n° 8, 19 avril, p. 96.
L'électrification du « Jura Neuchatelois ». (1 500 mots & fig.)

1930 669
Bull. technique de la Suisse Romande, n° 12, 14 juin, p. 147.
Les usages de l'**aluminium** et de ses alliages. (600 mots & tableau.)

Bulletin technique de l'Union professionnelle des inspecteurs techniques et des chefs de section des chemins de fer belges. (Bruxelles.)

1930 625 .111
Bull. tech. de l'Union profes. des insp. tech. et des chefs de section des ch. de fer belges, n° 39, 15 mars, p. 2.
MOERMAN (M.). — **Calcul d'un branchement.** (2 300 mots & fig.)

1930 625 .13

Bull. tech. de l'Union profes. des insp. tech. et des chefs de section des ch. de fer belges, n° 39, 15 mars, p. 14.

PAQUET (G.). — Remplacement de **tabliers métalliques** sur des lignes en service. (1 800 mots & fig.)

Chronique des transports. (Paris.)

1930 385 .113 (.44)

Chronique des transports, n° 7, 10 avril, p. 4.

Les **résultats de l'exploitation** de la Compagnie des chemins de fer de Paris à Orléans en 1929. (4 200 mots.)

1930 385 .113 (.44)

Chronique des transports, n° 8, 25 avril, p. 5.

Les **résultats de l'exploitation** de la Compagnie des chemins de fer de l'Est en 1929. (3 000 mots.)

1930 385 .113 (.44)

Chronique des transports, n° 9, 10 mai, p. 4.

Les **résultats de l'exploitation** de la Compagnie des chemins de fer du Midi en 1929. (4 000 mots.)

1930 385 .113 (.44)

Chronique des transports, n° 10, 25 mai, p. 3.

Les **résultats de l'exploitation** de la Compagnie de Paris à Lyon et à la Méditerranée en 1929. (6 000 mots.)

Génie civil. (Paris.)

1930 621 .114

Génie civil, n° 2484, 22 mars, p. 289.

La récupération par centrifugation des huiles usagées. (1 800 mots & fig.)

1930 625 .5 (.86)

Génie civil, n° 2485, 29 mars, p. 308.

Le **chemin de fer funiculaire** de Montserrate à Bogota (Colombie). (3 400 mots & fig.)

1930 62. (01

Génie civil, n° 2488, 19 avril, p. 378.

CAMPUS (F.). — Remarques sur la notion de la **charge critique de flambement.** (3 000 mots.)

1930 621 .110

Génie civil, n° 2489, 26 avril, p. 397.

MALGORN (G.). — **Accéléromètres enregistreurs** pour mécanismes animés d'un mouvement de rotation ou de translation. (4 700 mots & fig.)

1930 625 .111 (.44)

Génie civil, n° 2489, 26 avril, p. 404.

CAUFOURIER (P.). — **Amélioration de la ligne de Paris à Limours** (chemin de fer de Sceaux) à la sortie de Paris. (3 600 mots & fig.)

1930 669

Génie civil, n° 2490, 3 mai, p. 427; n° 2491, 10 mai, p. 449; n° 2492, 17 mai, p. 475.

GUILLET (L.). — Les récents progrès des **alliages légers d'aluminium.** (16 800 mots, 4 tabl. & fig.)

1930 656 .211 (.4

Génie civil, n° 2491, 10 mai, p. 445.

CALFAS (P.). — L'agrandissement de la gare l'Est, à Paris. — **Reconstruction du pont de l'Aqued** (1 900 mots & fig.)

1930 656 .211 (.4

Génie civil, n° 2492, 17 mai, p. 479.

CALFAS (P.). — L'agrandissement de la gare l'Est, à Paris. — **Reconstruction du pont Philippe-d Girard.** (1 700 mots & fig.)

1930 721

Génie civil, n° 2492, 17 mai, p. 487.

CAMPUS (F.). — **Correction de la fibre moyenne d voûtes de barrages.** (500 mots.)

1930 621 .132.8 (.43) & 621 .43 (.4

Génie civil, n° 2493, 24 mai, p. 497.

Locomotive Diesel-pneumatique de 1 200 chevaux d chemins de fer allemands. (2 700 mots & fig.)

1930 621

Génie civil, n° 2493, 24 mai, p. 500.

SABOURET. — L'emploi du **pont roulant** dans l grands entrepôts maritimes. (4 800 mots & fig.)

1930 69

Génie civil, n° 2494, 31 mai, p. 530; n° 2495, 7 jui p. 548.

MARCOTTE (E.). — Les progrès dans la fabricatio des **ciments hydrauliques.** (6 000 mots & fig.)

1930 621 .112 & 621 .11

Génie civil, n° 2496, 14 juin, p. 577.

Les **chaudières à haute pression.** — Chaudières fixe et chaudières pour locomotives. (3 100 mots & fig.)

1930 621 .11

Génie civil, n° 2496, 14 juin, p. 583.

La corrosion des chaudières et des surchauffeurs pa la vapeur surchauffée. (1 000 mots & fig.)

1930 621 .112 & 621 .11

Génie civil, n° 2497, 21 juin, p. 593.

Les chaudières à haute pression. — **Locomotive chaudière Löffler,** des établissements Schwartzkopf (2 500 mots & fig.)

La Science et la Vie. (Paris.)

1930 385. (09 (.65

La Science et la Vie, mai, p. 395.

L'Etat français exploite en Algérie un **réseau fer vraiment moderne.** (1 400 mots & fig.)

1930 625 .17

La Science et la Vie, mai, p. 437.

CAËL (J.). — Le **désherbage des voies ferrées** viei de recevoir une solution moderne. (1 000 mots & fig.)

s chemins de fer et les tramways. (Paris.)

30 621 .132.8 & 621 .43
hemins de fer et les tramways, avril, p. 64.
comotive Diesel de 300 H. P. à transmission hydrau- (2 600 mots & fig.)

30 625 .62
hemins de fer et les tramways, avril, p. 67.
IESS (E.). — **Voitures-tramways.** (3 300 mots & *(A suivre.)*

30 621 .135.4 (.44)
hemins de fer et les tramways, avril, p. 74.
aisseur de rails automatique de la Compagnie du in de fer de Paris à Orléans. (900 mots & fig.)

30 656 .222.4
hemins de fer et les tramways, avril, p. 79.
IRAUD (E.). — **Dispositif permettant de suivre tance la marche des trains.** (4 100 mots & fig.)

30 656 .21 (.44) & 621 .33 (.44)
hemins de fer et les tramways, mai, p. 87.
s grands travaux des chemins de fer français. (4 200 .)

30 625 .143.3
hemins de fer et les tramways, mai, p. 90.
sais comparatifs d'usure entre des rails traités au -carbone-titane et des rails non traités. (2 000 .)

30 625 .62
hemins de fer et les tramways, mai, p. 92.
IESS (E.). — **Voitures-tramways.** (7 000 mots & *(Suite.)*

30 665 .882
hemins de fer et les tramways, mai, p. 104.
océdé pour la **soudure aluminothermique** des rails. 0 mots & fig.)

30 656 .212.6
hemins de fer et les tramways, mai, p. 105.
spositif pour décharger des wagons. (800 mots &

dustrie des voies ferrées et des transports automobiles. (Paris.)

30
. voies ferrées et transp. autom., mars, p. 120.
CHAT (Ch.). — Le **chemin de fer électrique** de la droite du Lac de Thoune. (10 000 mots & fig.)

30 625 .142.4
. voies ferrées et transp. autom., avril, p. 154.
RARD (J.). — **Traverses en béton armé.** (1 100 & fig.)

1930 625 .143.3
L'Ind. voies ferrées et transp. autom., avril, p. 40.
BACQUEYRISSE. — Recherches complémentaires sur la **résistance à l'usure ondulatoire des aciers à rails.** (16 000 mots, 3 tabl. & fig.)

1930 625 .613
L'Ind. voies ferrées et transp. autom., avril, p. 60.
CALLOT. — Exposé relatif à quelques perfectionnements apportés dans **l'établissement des voies.** (9 300 mots & fig.)

1930 625 .611
L'Ind. voies ferrées et transp. autom., mai, p. 78.
BALENSI (R.) & VENTE (R.). — **Formules d'exploitation et coefficients d'intéressement du concessionnaire.** (15 600 mots, 6 tabl. & fig.)

Revue générale des chemins de fer. (Paris.)

1930 625 .1 (.44 + .460) & 625 .112 (.44 + .460)
Revue générale des chemins de fer, avril, p. 301.
GARAU. — **La question des transpyrénéens et celle de la pénétration de la voie européenne en Espagne.** (10 900 mots & fig.)

1930 625 .26 (.44)
Revue générale des chemins de fer, avril, p. 325.
GRISON (A.). — Note sur **l'entretien des voitures à bogies** des trains express et des rames de banlieue de la Compagnie des chemins de fer d'Orléans (6 500 mots & fig.)

1930 385 .587 (.44) & 625 .26 (.44)
Revue générale des chemins de fer, avril, p. 341.
L'emploi du **travail à la chaîne** dans les ateliers du matériel roulant de la Compagnie des chemins de fer de l'Est. (3 100 mots & fig.)

1930 625 .23 (.44)
Revue générale des chemins de fer, mai, p. 412.
LANCRENON. — Le nouveau **matériel métallique** du service de banlieue de la Compagnie du Nord. (4 000 mots & fig.)

1930 385. (09 (.51)
Revue générale des chemins de fer, mai, p. 432.
Les **chemins de fer chinois.** (4 000 mots, 3 tableaux & carte.)

1930 385 .113 (.43)
Revue générale des chemins de fer, mai, p. 445.
Les **chemins de fer allemands** pendant la cinquième année d'application du plan Dawes (1er septembre 1928-31 août 1929), d'après le Rapport n° 10 du Commissaire des Chemins de fer allemands à la Commission des Réparations. (7 000 mots & 2 tableaux.)

1930 656 .254 (.44)
Revue générale des chemins de fer, mai, p. 472.
Situation du **dispatching-system** en France, en décembre 1929. (1 100 mots & 1 carte.)

1930 625 .5
Revue générale des chemins de fer, mai, p. 476.
Les **funiculaires aériens** pour voyageurs. (900 mots, 2 tableaux & fig.)

Revue politique et parlementaire. (Paris.)

1930 385 (.3)
Revue politique et parlementaire, 10 mai, p. 326.
COLSON (C.). — Les **chemins de fer** en 1928 et 1929. (6 000 mots & 2 tableaux.)

Revue universelle des mines. (Liége.)

1930 624 .2
Revue universelle des mines, n° 7, 1er avril, p. 185.
VAN DEN DUNGEN (F. H.). — A propos de la **théorie vibratoire du flambage** des pièces chargées debout. (1 100 mots.)

1930 621 .2
Revue universelle des mines, n° 10, 15 mai, p. 292.
THOMAS (P.). — **La poutre Vierendeel.** (1 600 mots & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1930 347 .234
Archiv für Eisenbahnwesen, März-April, S. 317.
DURNIOK (E.). — Die Entstehung des heutigen **Enteignungsrechts** aus den Besonderheiten des Eisenbahnbaus. (Schluss.) (14 800 Wörter.)

1930 385. (09 (.56)
Archiv für Eisenbahnwesen, März-April, S. 351.
DIECKMANN. — Die **Eisenbahnen** im Französischen Mandatsgebiet Syrien und Libanon. (6 700 Wörter & Karten.)

1930 385 .113 (.43)
Archiv für Eisenbahnwesen, März-April, S. 381.
Die **Deutsche Reichsbahn** im Geschäftsjahr 1928. (15 000 Wörter.)

1930 313 .385 (.494)
Archiv für Eisenbahnwesen, März-April, S. 463.
Die **Eisenbahnen der Schweiz** in den Jahren 1926 und 1927. (3 600 Wörter.)

1930 385 .113 (.493)
Archiv für Eisenbahnwesen, März-April, S. 473.
Die **nationale Gesellschaft der belgischen Eisenbahnen** im zweiten Geschäftsjahr (1. Januar bis 31. Dezember 1928). (8 000 Wörter.)

1930 313 .385 (.4
Archiv für Eisenbahnwesen, März-April, S. 501.
Das **schwedische Eisenbahnnetz,** 1927 und 1928. (3 Wörter.)

1930 385. (09 (
Archiv für Eisenbahnwesen, März-April, S. 520.
Die **Eisenbahnen** in Chosen (Korea). (1 200 Wö und Karte.)

Elektrische Bahnen. (Berlin.)

1930 621
Elektrische Bahnen, Märzheft, S. 74.
WECHMANN (W.). — Die **elektrische Zugförder** auf ausserdeutschen Bahnen. (Schluss.) (9 600 Wört

1930 621 .335 (.4
Elektrische Bahnen, Märzheft, S. 82.
SACHS. — Neue schwere **Schnellzuglokomotiven** Schweizerischen Bundesbahnen. (2 000 Wörter & A

1930 621
Elektrische Bahnen, Märzheft, S. 85.
KOEPPEN (H.). — Die Kriterien **wirtschaftlich Geschwindigkeiten bei elektrischen Bahnen.** (Fort zung folgt.) (6 400 Wörter.)

1930 621 .335 (.
Elektrische Bahnen, Aprilheft, S. 103; Maiheft, S.
TETZLAFF. — **Reichsbahn-Wechselstrom-Trieb** gen für Nachbarorts- und Fernverkehr. (Schluss.) (8 Wörter & Abb.)

1930 621 .
Elektrische Bahnen, Aprilheft, S. 109.
OTTER (A.). — Neue Prüfeinrichtung für **Vollba fahrleitungen.** (2 800 Wörter & Abb.)

1930 621 .335 (.
Elektrische Bahnen, Maiheft, S. 129.
KLEINOW (W.). — **Reichsbahn-Schnellzuglokomot** mit Einzelachsantrieb der Bauart Westinghouse A. E (4 500 Wörter & Abb.)

1930 621 .
Elektrische Bahnen, Maiheft, S. 137.
BEIER (J.) & MUHRER (E.). — **Sicherheitsvorr tung** für elektrische Triebfahrzeuge nach System Bro Boveri. (5 200 Wörter & Abb.)

1930 621 .13 & 621 .
Elektrische Bahnen, Juniheft, S. 161.
WECHMANN (W.). — Betrachtungen über den e **trischen Zugbetrieb** im Vergleich zum Dampfbetr (2 600 Wörter & Abb.)

1930 621 .335 (.
Elektrische Bahnen, Juniheft, S. 164.
CURTIUS. — **Elektrische Messwagen** der Deutsc Reichsbahn. (4 800 Wörter & Abb.)

Elektrotechnische Zeitschrift. (Berlin.)

30 621 .33 (09
trotechnische Zeitschrift, Heft 13, 27. März, S. 461.
EICHEL (W.). — **Elektrische Stadtbahn** von der
ensschen Bahn 1879 bis zur Berliner Stadtbahn.
luss.) (2 200 Wörter & Abb.)

30 621 .31 (.431)
trotechnische Zeitschrift, Heft 14, 3. April, S. 485.
EICHEL (W.). — **Elektrische Stadtbahn** von der
tische Elektrizitätswerke Akt. Ges. (Schluss folgt.)
0 Wörter & Abb.)

30 621 .33 (.460)
trotechnische Zeitschrift, Heft 14, 3. April, S. 511.
Urola-Bahn Zumárrága-Zumaya (Spanien). (700
er & Abb.)

30 621 .33 (.485)
trotechnische Zeitschrift, Heft 16, 17 April, S. 571.
wirtschaftlichen Ergebnisse der Elektrisierung
Staatsbahnstrecke Stockholm-Gotenburg. (3 000
er.)

30 621 .33 (.436)
trotechnische Zeitschrift, Heft 19, 8. Mai, S. 669.
ETHAMMER (F.). — Die **elektrischen Bahnen** in
schechoslowakischen Republik. (3 700 Wörter.)

Glasers Annalen. (Berlin.)

30 385. (09. (.42)
rs Annalen, Nr. 1266, 15. März, S. 69.
NKEL. — Die Entwicklung der **englischen Eisen-**
en in der Nachkriegszeit (1921-1927). (4 200
er.)

30 621 .133.1 (06
rs Annalen, Nr. 1267, 1. April, S. 81.
GT. — Bericht über die **Brennstofftagung** der
kraftkonferenz in London. (6 900 Wörter.)

30 621 .134.1
rs Annalen, Nr. 1267, 1. April, S. 87.
NZEL (O.). — Ein Beitrag zur Berechnung der
genschäfte mit I-Querschnitt von **Treib- und Kup-**
angen für Lokomotiven. (1 400 Wörter & Abb.)

30 621 .132.8 (.43)
rs Annalen, Nr. 1267, 1. April, S. 90.
erste deutsche **Turbinenlokomotive** (Bauart
p). (800 Wörter & Abb.)

30 621 .133.1
rs Annalen, Nr. 1268, 15. April, S. 93.
OCKAT (Fr.). — Beiträge zur **Kohlenstaubfrage.**
bscheidung von Staub aus waagerechten Gasströ-
(Fortsetzung.) (3 700 Wörter & Abb.)

30 669 (.43)
rs Annalen, Nr. 1269, 1. Mai, S. 107.
RKLEN. — Neues **Metallreinigungsverfahren** für
sbahn-Aussbesserungswerke. (2 400 Wörter &

In English.

Bulletin American Railway Engineering Association. (Chicago.)

1929 656 .21 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 322, Dec., p. 773.
Report of Committee on yards and terminals. (17 000 words & fig.)

1929 657 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 322, Dec., p. 823.
Report of Committee on records and accounts. (39 000 words, tables & fig.)

1929 621 .138 (.73) & 725 .33 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 322, Dec., p. 953.
Report of Committee on shops and locomotive terminals. (5 500 words & fig.)

1929 624. (0 & 721 .9
Bull. Amer. Ry. Eng. Ass^{on}, No. 322, Dec., p. 973.
Report of Committee on iron and steel structures (8 500 words, tables & diagrams.)

1929 656 (02 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 322, Dec., p. 1001.
Report of Committee on economics of railway operation. (10 000 words, tables & fig.)

1929 624 .2
Bull. Amer. Ry. Eng. Ass^{on}, No. 322, Dec., p. 1031.
LEFFLER (B. R.). — **A study of the causes of impact on railway bridges** (continued). (2 000 words.)

1930 656 .25 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 323, Jan., p. 1037.
Report of Committee on signals and interlocking. (7 000 words & tables.)

1930 625 .142 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 323, Jan., p. 1065.
Report of Committee on ties. (8 000 words, tables & fig.)

1930 693 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 323, Jan., p. 1147.
Report of Committee on masonry. (9 000 words & fig.)

1930 725 .3 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 323, Jan., p. 1193.
Report of Committee on buildings. (11 500 words, tables & fig.)

1930 625 .11 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 323, Jan., p. 1231.
Report of Committee on economics of railway location. (6 000 words & fig.)

1930 385 .5 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 323, Jan., p. 1251.
Report of Committee on economics of railway labor. (19 000 words, tables & fig.)

1930 621 (.73) & 656 .213 (.73)
Bull. Amer. Ry. Eng. Ass^on, No. 324, Febr., p. 1331.
Report of special Committee on rivers and harbors. (10 000 words, tables & fig.)

1930 624 .2 (.73)
Bull. Amer. Ry. Eng. Ass^on, No. 324, Febr., p. 1381.
Report of Committee on wooden bridges and trestles. (4 000 words, tables & fig.)

1930 621 .3 (.73)
Bull. Amer. Ry. Eng. Ass^on, No. 324, Febr., p. 1415.
Report of Committee on electricity. (8 500 words & tables.)

1930 625 .143 (.73)
Bull. Amer. Ry. Eng. Ass^on, No. 324, Febr., p. 1449.
Report of Committee on rail. (32 000 words, tables & fig.)

1930 625 .143.3 (08
Bull. Amer. Ry. Eng. Ass^on, No. 324, Febr., p. 1619.
CUSHING (W. C.). — **The heat-treated rails in the tracks.** (8 000 words, tables & fig.)

1930 625 .1 (.73)
Bull. Amer. Ry. Eng. Ass^on, No. 324, Febr., p. 1671.
JONAH (F. G. Colonel). — **Notes on construction of St. Louis, Brownsville & Mexico Railway.** (2 000 words.)

Electric Railway Journal. (New York.)

1930 621 .338 (.73)
Electric Railway Journal, February, p. 78.
New Albany car includes many innovations. (2 400 words & fig.)

1930 656 .25
Electric Railway Journal, February, p. 82.
MATSON (T. M.). — Correct **timing signals** essential in traffic regulation. Part one. (1 800 words & fig.)

1930 656 .1 (.73)
Electric Railway Journal, February, p. 91.
STAUFFER (J. R.). — Opportunities for **profits in de luxe bus operation.** (3 500 words, table & fig.)

1930 625 .144.4 (.73)
Electric Railway Journal, February, p. 101.
Building **concrete track** with minimum interruption of service. (900 words & fig.)

1930 625 .172 (.73)
Electric Railway Journal, February, p. 104.
PIRKLE (A. G.). — Spray equipment effective for **weed killing.** (400 words & fig.)

1930 385 .586 (.73)
Electric Railway Journal, March, p. 133.
SUMMERS (L. E.). — **Operating delays** reduced by practical instruction methods. (1 900 words & fig.)

1930 625 .14 (.7
Electric Railway Journal, March, p. 154.
MALL (I. O.). — **Track without ties** built at N Orleans. (2 500 words & fig.)

1930 625 .235 (.7
Electric Railway Journal, April, p. 184.
FAUST (C. L.). — **Aluminum** gaining favor for construction. (3 600 words, table & fig.)

1930 625 .14 (.7
Electric Railway Journal, April, p. 191.
Single life versus renewable track. (3 600 words fig.)

1930 625 .26 (.7
Electric Railway Journal, April, p. 201.
Shop efficiency improved by **unit replacement syste** (2 800 words, tables & fig.)

1930 621 .33 (.7
Electric Railway Journal, April, p. 212.
WRIGHT (G. I.). — **Reading Company's Philadelp suburban electrification** making rapid progress. (2 words & fig.)

Engineer. (London.)

1930 621 .134.3 (.4
Engineer, N° 3864, 31 January, p. 132.
London & North Eastern Railway. — **Locomot with Lentz valve gear.** (1 000 words & fig.)

1930 621 .18 (.
Engineer, Nos. 3864, 31 January, p. 142; No. 38 7 February, p. 171; No. 3866, 14 February, p. 1
WATSON SMYTH (E.). — General operation ex riences with the first « Wood » **steam generator.** (10 words & fig.)

1930 625 .258 & 625
Engineer, No. 3865, 7 February, p. 158.
Wagon retarders for shunting on railways. (2 words & fig.)

1930 621 .18 (.
Engineer, No. 3866, 14 February, p. 184.
Projects for **tunnelling the straits of Gibraltar.** (2 words & fig.)

1930
Engineer, No. 3868, 28 February, p. 232; No. 3 7 March, p. 261; No. 3870, 14 March, p. 2 No. 3872, 28 March, p. 342.
SELWYN CASWELL (J.). — **The rolling of met** (24 000 words & fig.)

1930 62. (01 & 66
Engineer, No. 3868, 28 February, p. 238; No. 3 7 March, p. 262.
HAIGH (B. P.). — The relative safety of **mild high-tensile alloy steels** under alternating and pulsat stresses. (10 300 words & fig.)

1930 625 .616 (.83)
gineer, No. 3869, 7 March, p. 265.
A 300 B. H. P. oil engine-driven locomotive. (1 700 rds & fig.)

1930 621 .43
gineer, No. 3869, 7 March, p. 280.
Diesel Engine Users Association. (3 200 words.)

1930 621 .33 (.494)
gineer, No. 3871, 21 March, p. 318.
Electrification of the Visp-Zermatt Railway. (2 800 rds & fig.)

1930 625 .13 (.42 + .44)
gineer, No. 3871, 21 March, p. 327.
The Channel tunnel. (3 300 words.)

1930 621 .132.8 (.83)
gineer, No. 3872, 28 March, p. 348.
Articuled steam rail coach for Egypt. (1 400 words & .)

1930 621 .31
gineer, No. 3872, 28 March, p. 357.
High-power mercury arc rectifiers. (2 100 words.)

1930 621 .335 (.494)
gineer, No. 3872, 28 March, p. 359.
A 7 200 horse-power single-phase locomotive. (650 rds & fig.)

1930 669 .1
e Metallurgist, Supplement to the Engineer, No. 3872, 28 March, 1930, p. 38.
mprovements in structural steel. (2 200 words.)

1930 62. (01 & 621 .133.3
e Metallurgist, Supplement to the Engineer, No. 3872, 28 March, 1930, p. 39.
Working stresses of boiler steels at high temperatures. 100 words.)

1930 656 .281 (.42)
gineer, 18 April, p. 436.
An unusual railway accident. (1 200 words & fig.)

1930 621 .138.2 (.42)
gineer, 18 April, p. 442.
London & North Eastern Railway coaling plant in tland. (600 words & fig.)

1930 669
e Metallurgist, Supplement to the Engineer, 25 April 1930, p. 51.
ndustrial heat-treated aluminium alloys. (1 700 rds.)

1930 669 .1
Metallurgist, Supplement to the Engineer, 25 April 1930, p. 52.
itrogen case-hardening. (2 300 words & fig.)

1930 62. (01 & 669
The Metallurgist, Supplement to the Engineer, 25 April 1930, p. 55.
Fatigue and fatigue testing. — No. I. (1 100 words.)

Engineering. (London.)

1930 621 .134.3 (.42)
Engineering, No. 3342, 31 January, p. 133.
4-6-0 type four-cylinder locomotive fitted with Beard-more-Caprotti valve gear. (900 words.)

1930 669 .1
Engineering, No. 3342, 31 January, p. 141.
The heat treatment of steel. (2 500 words.)

1930 621 .1
Engineering, No. 3342, 31 January, p. 149.
WATSON SMYTH (E.). — General operation experiences with the first « Wood » steam generator. (6 500 words & fig.) (Concluded.)

1930 62. (01
Engineering, No. 3345, 21 February, p. 252.
The Monotron hardness indicator. (1 200 words.)

1930 62. (01 & 669 .1
Engineering, No. 3345, 21 February, p. 264; No. 3347, 7 March, p. 327.
BAILY (R. W.). — Creep of steel under simple and compound stresses. (6 900 words, 1 tab. & fig.)

1930 621 .132.8 (.43)
Engineering, No. 3346, 28 February, p. 280.
2 000 H. P. Krupp turbine locomotive. (1 800 words & fig.)

1930 656 .213 (.493)
Engineering, No. 3347, 7 March, p. 305.
Potash storage and shipment plant at Antwerp. (3 300 words & fig.)

1930 621 .132.8 (.42)
Engineering, No. 3347, 7 March, p. 325.
300 H. P. Diesel locomotive. (1 500 words & fig.)

1930 621 .132.3 (.44)
Engineering, No. 3348, 14 March, p. 334.
MONKSWELL (Lord). — The 4-8-2 type express locomotive of the Chemin de fer de l'Est. (3 600 words & fig.)

1930 621 .392
Engineering, No. 3348, 14 March, p. 349.
The training of welders. (2 500 words.)

1930 621 .392 & 669 .1
Engineering, No. 3348, 14 March, p. 362; p. 427.
SCHUSTER (L. W.). — The strength and design of fusion welds for unfired pressure vessels. (9 100 words & fig.)

1930 625 .13 (.42 + .44)
Engineering, No. 3349, 21 March, p. 381.
The Channel tunnel. (2 200 words.)

1930 621 .132.3 (.42)
Engineering, No. 3350, 28 March, p. 408.
4-4-0 type « V » class passenger locomotive for the Southern Railway. (700 words.)

1930 621 .4 (.43)
Engineering, No. 3350, 28 March, p. 409.
Airless-injection engine. (1 000 words.)

1930 669 .1
Engineering, No. 3350, 28 March, p. 413.
The case for **Bessemer steel.** (2 500 words.)

1930 656 .1
Engineering, No. 3350, 28 March, p. 414.
The **road-traffic problem.** (2 100 words.)

1930 621 .116
Engineering, No. 3350, 28 March, p. 421.
Gilled tubes for boiler combustion chambers. (900 words.)

1930 621 .165
Engineering, No. 3350, 28 March, p. 421.
RICKLI (H.). — Mechanical degree of safety in large **turbo-generators.** (5 200 words & fig.)

1930 625 .13 (.42)
Engineering, No. 3350, 28 March, p. 425.
SMITH (H. D.). — **Railway bridge reconstruction.** (1 100 words.)

1930 621 .94
Engineering, 4 April, p. 456.
High-power plain milling machine. (2 200 words & fig.)

1930 62. (01
Engineering, 11 April, p. 465.
COKER (Prof. E. G.). — **Lateral extensometers** (2 500 words & fig.)

1930 621 .91
Engineering, 11 April, p. 476.
Reversing gear for planing machines. (1 700 words & fig.)

1930 624 .62 (.944)
Engineering, 18 April, p. 495 and 25 April, p. 533.
The Sidney Harbour **bridge.** (5 500 words & fig.)

1930 625 .13 (.54)
Engineering, 18 April, p. 503.
Bridge reconstruction in India. The rebuilding of the Bassim bridges on the Bombay, Baroda and Central India Railway (by B. B. HASKEW). (600 words.) The reconstruction of the Attoch bridge across the river Indus on the North Western Railway (by W. T. EVERALL). (1 000 words.)

1930 621 .132.7 (.42) & 621 .43 (.42
Engineering, 18 April, p. 504.
12-ton **petrol locomotive.** (1 000 words & fig.)

1930 621 .133
Engineering, 25 April, p. 527.
DOCHERTY (James Gray). — The thickness **boiler tubes.** (3 000 words & diagrams.)

1930 625 .212 & 625 .143
Engineering, 25 April, p. 538.
Automatic **flange lubricator for railway rolling stock** (1 000 words & fig.)

1930 621 .3
Engineering, 25 April, p. 557.
The Harland **oil circuit-breaker.** (1 000 words & fig

Engineering News-Record. (New York.)

1930 621 .392 (.73
Engineering News-Record, 23 January, p. 144.
WALLACE (H. J.). — Heaviest **welded truss erected** in Glendale, California. (1 500 words & fig.)

1930 624 .51 (.73
Engineering News-Record, 13 February, p. 272.
STEINMAN (D. B.). — **Rope-strand cables used i new bridge** at Portland, Oregon. (3 500 words & fig.)

1930 624 .7 (.73
Engineering News-Record, 13 February, p. 282.
FOWLER (W. H.). — **Overhead trusses carry arc centering** for Pennsylvania Railroad bridge at Philadelphia. (1 350 words & fig.)

1930 624 .9 (.73
Engineering News-Record, 20 February, p. 314.
TEMPLIN (R. L.) and HARTMANN (E. C.). — Pioneer tests of **aluminum beams reveal good structura qualities.** (1 350 words, 4 tables & fig.)

1930 624 .63 (.73
Engineering News-Record, 20 February, p. 317.
GOODKIND (Morris). — Two high travelling towe with chutes place **concrete** on New Brunswick multipl arch bridge. (3 300 words & fig.)

1930 624 .0 (.73
Engineering News-Record, 20 February, p. 327.
WAY (W. F.). — **High concrete stresses used in desig of viaduct** of novel design. (1 900 words & fig.)

1930 691 (06 (08 (.73
Engineering News-Record, 20 February, p. 73.
Timely **concrete problems** discussed at Convention American Concrete Institution, 11-13 February 193 (5 400 words & fig.)

1930 721
Engineering News-Record, 27 February, p. 350.
BUDD (Ralph), DOWNS (L. A.) and LEE (Elisha — One of today's railway problems : **Co-ordinatin various forms of transport.** (11 000 words & fig.)

1930 625 .13 (.73)
ngineering News-Record, 27 February, p. 359.
1 316-foot Chesapeake & Ohio Railway **tunnel** elimi-ated under traffic by deep open cut. (1 900 words & g.)

1930 625 .1 (.73)
ngineering News-Record, 27 February, p. 360.
HALE (H. E.). — Engineering **costs on railroad con-truction.** (3 900 words & fig.)

1930 625 .14 (.73)
ngineering News-Record, 27 February, p. 365.
CHIPMAN (P.). — Pere Marquette Railway extends s **concrete roadbed.** (1 900 words & fig.)

1930 625 .13 (.52)
ngineering News-Record, 27 February, p. 367.
Driving the Tanna Railway **tunnel** in Japan. (4 000 ords & fig.)

1930 625 .1 (.73)
ngineering News-Record, 6 March, p. 396.
New line for Kansas City Southern Railway. (2 500 ords & fig.)

1930 625 .13 (.73)
ngineering News-Record, 6 March, p. 407.
Reinforcing railroad bridge piers under heavy traffic. 700 words & fig.)

1930 625 .1 (06 (08 (.73)
ngineering News-Record, 20 March, p. 489.
Economic and research problems discussed by Railway ngineers (Annual Meeting of the A. R. E. A., 11 to March 1930). (5 400 words.)

1930 725 .32 (.73)
ngineering News-Record, 27 March, p. 519.
HIRSCHTHAL (M.). — Design of Lackawanna's **inforced concrete freight terminal** warehouse at Jersey ty. (4 700 words & fig.)

1930 624 .63 (.73)
ngineering News-Record, 27 March, p. 525.
BUTTLER (Merrill) and ENGER (A. L.). — Method constructing long **viaduct of concrete arches.** (1 900 ords & fig.)

urnal of the Institute of Transport. (London.)

1930 313 .385. (01
urnal of the Institute of Transport, February, p. 171.
BELL (R.). — Faith in **statistics.** (6 000 words.)

1930 625 .2 (0 (.3 + .42)
urnal of the Institute of Transport, February, p. 180.
HERRINGTON (C. E. R.). — British and foreign **ling stock** compared. (2 500 words, 2 tables & fig.)

1930 656
urnal of the Institute of Transport, February, p. 185.
HARVERSON (P. A.). — **Passenger transportation** its past, its present and its future. (3 500 words.)

1930 347 .763 (.42)
Journal of the Institute of Transport, February, p. 191.
PITTARD (R. G.). — Some notes and comments on the **road traffic** bill, 1929. (2 500 words.)

1930 385 .1 & 656
Journal of the Institute of Transport, March, p. 209.
SELBIE (R. H.). — The administration of **transport undertakings** — finance and statistics. (4 000 words.)

1930 385 (.6)
Journal of the Institute of Transport, March, p. 224.
TRAVIS (Ch.). — The **railways** of Africa. (3 500 words & table.)

1930 656 .231 (.82)
Journal of the Institute of Transport, March, p. 233.
HOLLAND (W. C.). — Argentine **railway rates and fares.** (3 500 words.)

Mechanical Engineering. (New York.)

1930 621 .89
Mechanical Engineering, February, p. 114.
MICHELL (A. G. M.). — Progress of fluid-film **lubrication.** (2 700 words & fig.)

1930 621 .111 & 51 (08
Mechanical Engineering, February, p. 121.
International **steam table conference.** — Skeleton **steam tables.** (2 200 words & tables.)

1930 621 .111
Mechanical Engineering, February, p. 127.
OSBORNE (N. S.), STIMSON (H. F.) and FIOCK (E. E.). — Report on progress in **steam research** at the Bureau of standards, with determination of heat content and latent heat up to 270 degrees Cent. (2 900 words, 2 tables & fig.)

1930 536
Mechanical Engineering, February, p. 139.
MUELLER (E. F.). — The passing of the **mechanical equivalent of heat.** (2 500 words & fig.)

1930 621 .116 & 669 .1
Mechanical Engineering, March, p. 193.
Mc LEAN JASPERS (T.). — Building vessels for high-pressure and high-temperature service. (4 800 words & fig.)

1930 621 .31
Mechanical Engineering, March, p. 201.
JOHNSON (Willard C.). — Modern trends in the **design and application of electric motors.** (3 500 words & fig.)

Modern Transport. (London.)

1930 625 .232 (.44)
Modern Transport, No. 569, 8 February, p. 3.
All-steel coaches for suburban services. (800 words & fig.)

1930 385. (061 (.4)
Modern Transport, No. 569, 8 February, p. 4.
POURCEL (A.). — **The International Railway Union.** (1 700 words.)

1930 625 .62
Modern Transport, No. 569, 8 February, p. 5.
Tramways and trackless trolley undertakings. (1 000 words.)

1930 625 .13 (.67)
Modern Transport, No. 569, 8 February, p. 11.
Strengthening of Victoria Falls bridge. (1 600 words & fig.)

1930 656 .1 (.73) & 656 .2 (.73)
Modern Transport, No. 569, 8 February, p. 12.
Road transport in the United States. (1 100 words.)

1930 625 .62
Modern Transport, No. 570, 15 February, p. 3.
Trams, buses and trackless trolley vehicles. (1 600 words.)

1930 625 .24 (.42)
Modern Transport, No. 570, 15 February, p. 7.
High-capacity wagons on British railways. (1 500 words & fig.)

1930 624 .63
Modern Transport, No. 570, 15 February, p. 11.
Ferro-concrete in bridge construction. (1 700 words & fig.)

1930 625 .3 (.67)
Modern Transport, No. 571, 22 February, p. 3.
« River trains » in the Belgian Congo. (1 200 words & fig.)

1930 625 .62
Modern Transport, No. 571, 22 February, p. 4.
Trams, buses and trackless trolley vehicles. (1 700 words.)

1930 621 .134.3 (.43)
Modern Transport, No. 571, 22 February, p. 5.
A super-high-pressure steam locomotive. (1 200 words & fig.)

1930 621 .132.8 (.54)
Modern Transport, No. 571, 22 February, p. 7.
Sixteen **234-ton locomotives** for India. (1 600 words & fig.)

1930 313 .385
Modern Transport, No. 571, 22 February, p. 8.
Transport administration. (1 600 words.)

1930 625 .2 (0 (.3 + .42)
Modern Transport, No. 571, 22 February, p. 10.
SHERRINGTON (C. E. R.). — **British and foreign injection Diesel engines.** (1 700 words.)

1930 656 .2
Modern Transport, No. 571, 22 February, p. 12.
DAVIES (E. H.). — **Goods station working and ancillary services.** (2 600 words & fig.)

1930 385 .4 (.42
Modern Transport, No. 572, 1 March, p. 2.
Southern Railway reorganisation. (3 000 words.)

1930 625 .13 (.42
Modern Transport, No. 572, 1 March, p. 5.
Reconstruction of Lambeth bridge. (2 000 words & fig.)

1930 656 .1 (.68) & 656 .2 (.68
Modern Transport, No. 572, 1 March, p. 7.
Road competition in South Africa. (1 400 words.)

1930 656. (.94
Modern Transport, No. 572, 1 March, p. 10.
Transport developments in Australia. (1 700 words.

1930 625 .232 (.494
Modern Transport, No. 572, 1 March, p. 11.
Railway carriages for invalids. (900 words & fig.)

1930 625 .142.
Modern Transport, No. 572, 1 March, p. 13.
Steel railway sleepers. (1 000 words.)

1930 385 .4 (.42
Modern Transport, No. 572, 1 March, p. 15.
Reorganisation on the Southern Railway. (2 70 words.)

1930 385 .63 (.3) & 656 .222
Modern Transport, No. 573, 8 March, p. 5.
Containers for international goods traffic. (2 80 words & fig.)

1930 621 .132.8 (.83) & 621 .43 (.83
Modern Transport, No. 573, 8 March, p. 7.
Diesel engines for railway operation. (1 600 wor & fig.)

1930 385. (09.1 (.51
Modern Transport, No. 573, 8 March, p. 15.
The Chinese railway position. (1 500 words & fig.)

1930 656 .213 (.42
Modern Transport, No. 574, 15 March, p. 3.
Freight handling on the Great Western Railway (2 500 words.)

1930 656 .211
Modern Transport, No. 574, 15 March, p. 12.
Arrangement of **passenger train services.** (1 600 wor & fig.)

1930 621 .4
Modern Transport, No. 574, 15 March, p. 15.
Mc LAREN (J. A.) & Mc LAREN (H.). — **Airle injection Diesel engines.** (1 700 words.)

1930 385. (09.1 (.51)
Modern Transport, No. 575, 22 March, p. 4.
BURTT (Ph.). — **South Manchuria Railway.** (1 700 words.)

1930 625 .13 (.42 + .44)
Modern Transport, No. 575, 22 March, p. 5.
Channel tunnel report. (2 700 words & fig.)

1930 625 .213 (.494)
Modern Transport, No. 575, 22 March, p. 7.
Handling of **perishable traffic.** (700 words & fig.)

1930 656 .223 (.42)
Modern Transport, No. 575, 22 March, p. 9.
Ownership of **mineral wagons.** (1 200 words.)

1930 621 .31 (.52)
Modern Transport, No. 575, March 22, p. 11.
Electrical equipment for Japanese Railways. (1 500 words & fig.)

1930 621 .132.8 (.62)
Modern Transport, No. 576, March 29, p. 3.
British-built **rail cars** for Egypt. (3 100 words & fig.)

1930 621 .132.3 (.42)
Modern Transport, No. 576, March 29, p. 5.
Most powerful **4-4-0 type locomotives** in Great Britain. (500 words & fig.)

1930 385 .113 (.54)
Modern Transport, No. 576, March 29, p. 6.
Reduced receipts on Indian Railways. (2 100 words.)

1930 656 .2
Modern Transport, No. 576, March 29, p. 8.
HARE (Bernard, T.). — **Practical railway operation.** I. — Introductory. (1 700 words.)

1930 621 .43
Modern Transport, No. 576, March 29, p. 11.
RICARDO (H. R.). — **High-speed Diesel engines.** (1 700 words.)

1930 656 .2
Modern Transport, No. 576, March 29, p. 3.
HARE (Bernard, T.). — **Practical railway operation.** II. — The problem of line occupation. (1 600 words & fig.)

1930 656 .1
Modern Transport, No. 577, 5 April, p. 2.
Motor taxation. (2 000 words & fig.)

1930 385. (09.1 (.91)
Modern Transport, No. 577, 5 April, p. 4.
North Borneo State Railway. (700 words.)

1930 656 .212.6 (.42) & 656 .222.6
Modern Transport, No. 577, 5 April, p. 7.
Handling of **goods traffic.** (1 600 words & fig.)

1930 625 .1 (.43)
Modern Transport, No. 577, 5 April, p. 9.
Railway improvement in East Prussia. (1 800 words & fig.)

1930 621 .33 (.42) & 625 .4 (.42)
Modern Transport, No. 577, 5 April, p. 11.
Railway electrification and tube extensions (London). (2 500 words & fig.)

1930 385 .113 (.42)
Modern Transport, No. 577, 5 April, p. 26.
Railway traffic receipts. (200 words, 1 table & fig.)

1930 656 .251
Modern Transport, No. 578, 12 April, p. 3.
GRIFFITHS (R. S.) & LASCELLES (T. S.). — Problem of **signal aspects.** (2 100 words.)

1930 621 .33 (.42)
Modern Transport, No. 578, 12 April, p. 6.
WEDGWOOD (Sir Ralph). — **Railway electrification** in North London. (1 500 words & fig.)

1930 656 .2
Modern Transport, No. 578, 12 April, p. 7.
HARE (Bernard, T.). — **Practical railway operation.** III. — Effect of speed on line capacity. (1 600 words & fig.)

1930 656 .222.4 & 656 .25
Modern Transport, 19 April, p. 3.
HARE (B. T.). — Practical railway operation. IV. — **Effect of signalling arrangements on line capacity.** (1 600 words & fig.)

1930 621 .132.3 (.54)
Modern Transport, 19 April, p. 5.
British-built **locomotives for India. Experimental « X. S. 1. » and « X. S. 2. » engines** of the North Western State Railway. (1 000 words & fig.)

1930 656 .213
Modern Transport, 19 April, p. 7.
Dock capacity. — Actual and potential user. (1 300 words & fig.)

1930 625 .111 (.42)
Modern Transport, 19 April, p. 8.
Charing Cross **Bridge** bill. — House of Commons Committee reject proposed station site. (1 800 words & fig.)

1930 385. (09 (.460)
Modern Transport, 26 April, p. 3.
The **Railways of Spain. — Development. Amalgamation. Organisation.** (5 000 words & fig.)

1930 656 .222.4
Modern Transport, 26 April, p. 11.
HARE (B. T.). — Practical railway operation. V. — **Problems of line occupation. A typical case.** (2 100 words & fig.)

Proceedings, American Society of Civil Engineers. (New York.)

1930 **624 .62 (.73)**
Proceed. Amer. Soc. civil Eng., March, p. 487.
AMMANN (O. H.). — **Plans and research — Kill van Kull bridge.** (8 500 words & fig.)

1930 **625 .13 (.73)**
Proceed. Amer. Soc. civil Eng., March, p. 531.
HALE (H. M.). — **Hydraulic plant and its application to underpinning structures along the Nassau street subway.** (3 000 words & fig.)

1930 **385 .21 (.73)**
Proceed. Amer. Soc. civil Eng., March, p. 546.
ASHBURN (T. Q.). — **Waterway transportation from the viewpoint of operation.** (4 500 words & fig.)

1930 **385 .21 (.73)**
Proceed. Amer. Soc. civil Eng., March, p. 561.
CORNISH (L. D.). — **Railway versus waterways : an economic comparison.** (7 500 words, tables & fig.)

1930 **385 .21 (.73)**
Proceed. Amer. Soc. civil Eng., March, p. 582.
HADLEY (E. A.). — **Relation between rail and waterway transportation.** (3 000 words).

1930 **624. (0 (.73)**
Proceed. Amer. Soc. civil Eng., March, p. 637.
General specifications for steel railway bridges prepared by committees from the American Society of of civil engineers and the American Railway Engineering Association. (6 000 words & 1 table.) (To be continued.)

1930 **625 .13 (.73)**
Proceed. Amer. Soc. civil Eng., April, p. 679.
CLIFFORD ALLEN BETTS. — **Completion of Moffat tunnel of Colorado.** (11 500 words, tables & fig.)

1930 **624. (0 (.73)**
Proceed. Amer. Soc. civil Eng., April, p. 881.
General specification for steel railway bridges prepared by committees from the American Society of civil engineers and the American Railway Engineering Association. (2 500 words.) (Concluded.)

1930 **385 .21 (.73)**
Proceed. Amer. Soc. civil Eng., April. p. 895.
SORRELL (C. Lewis). — **Relation between rail and waterway transportation: a symposium.** (3 500 words.)

Railway Age. (New York.)

1930 **656 .211.7 (.73)**
Railway Age. 18 January. p. 187.
Bridging San Francisco Bay (**ferry service, Southern Railway**). (2 500 words, 3 tables & fig.)

1930 **625 .142.2 (.73) & 691 (.73)**
Railway Age. 18 January. p. 190.
Great Northern treats **ties** in modern plant. (2 500 words & fig.)

1930 **656 .222 (.73)**
Railway Age, 18 January, p. 195.
Manufacturers and steel producers testify to **improved railway service** (continued) (7 000 words & fig.)

1930 **656 .254 (.73)**
Railway Age, 18 January, p. 201.
Low **rates** offered to stimulate holiday travel. (2 600 words.)

1930 **725 .33 (.71)**
Railway Age, 18 January, p. 203.
Fireless **engine terminal** on the Great Northern. (1 900 words & fig.)

1930 **621 .139 (.4), 625 .18 (.4) & 625 .27 (.4)**
Railway Age, 18 January, p. 206 and 25 January, p. 253.
HARRIMAN (N. E.). — **Purchasing and stores methods on European railroads** (continued and concluded). (3 400 words & fig.)

1930 **656 .1 (.73) & 656 .261 (.73)**
Railway Age. Section one. 25 January, p. 231 and 1 February, p. 337.
LISMAN (F. J.). — The feasibility of the Interstate Commerce Commission **consolidation plan.** (12 000 words & map.)

1930 **625 .142. (73)**
Railway Age, Section one. 25 January, p. 237.
Pere Marquette builds new type of **concrete roadbed.** (1 700 words & fig.)

1930 **625 .232 (.73)**
Railway Age. Section one. 25 January, p. 241.
Distinctive **dining cars** acquired by the Union Pacific. (1 200 words & fig.)

1930 **625 .245 (.73) & 656 .2 (.73)**
Railway Age, Section one, 25 January, p. 245.
Railways enable oil industry to increase use of **tank cars** (continued from 25 January number.) (4 700 words & fig.)

1930 **621 .133.3 (.73)**
Railway Age, Section one. 25 January. p. 255.
Tests of the Martin circulator. (1 000 words & fig.)

1930 **656 .1 (.73) & 656 .261 (.73)**
Railway Age. Section two. 25 January. p. 278.
The **Railway Express Agency.** (3 000 words. 2 tables & fig.)

1930 **656 .261 (.73)**
Railway Age. Section two. 25 January. p. 286.
How New York Central transfers **freight by truck.** (1 600 words & fig.)

1930 **656 .1 (.73)**
Railway Age. Section two. 25 January. p. 291.
FERGUSON (A. D.). — An analysis of **motor truck taxation.** (3 800 words. 2 tables & fig.)

1930 656 .212.6 (.73)
Railway Age, 1 February, p. 329.
Chicago and North Western improves **oil handling.** (1 700 words & fig.)

1930 656 .255 (.73)
Railway Age, 1 February, p. 332.
MOLIS (B. W.). — The Denver and Rio Grande Western installs **centralized traffic control on 32 miles of single track.** (1 100 words & fig.)

1930 625 .25 (.73)
Railway Age, 1 February, p. 347.
Contribution of the air brake to transportation. (2 100 words & fig.)

1930 625 .151 (.73)
Railway Age, 1 February, p. 351.
A new design of **switch lock.** (400 words & fig.)

1930 656 .257 (.73)
Railway Age, 8 February, p. 373.
LEROY WYANT. — Rock Island develops **interlocking with no mechanical locking.** (2 000 words & fig.)

1930 625 .235 & 625 .246
Railway Age, 8 February, p. 377.
Railroad use of **aluminum alloys.** (3 300 words & fig.)

1930 625 .142.2 (06 (.73) & 691. (06 (.73)
Railway Age, 8 February, p. 383.
Wood Preservers give railways prominent place on program (annual convention). (6 000 words & fig.)

1930 621 .86 (.73)
Railway Age, 8 Febuary, p. 389.
Missouri-Kansas-Texas develop **conveyor for loading scrap.** (1 100 words & fig.)

1930 656 .233 (.73)
Railway Age, 15 February, p. 423.
Pooling ore traffic results in savings (Northern Pacific-Soo Line). (1 400 words & fig.)

1930 625 .214 (.73)
Railway Age, 15 February, p. 425.
Atlantic Coast Line builds « dope » laundry **(reclaiming of journal packing and lubricating oil).** (1 100 words & fig.)

1930 621 .335 (.44)
Railway Age, 15 February, p. 427.
JAPIOT (M.). — Paris-Lyons-Mediterranean Railway adopts **5 300-horse-power electric locomotives.** (1 200 words & fig.)

1930 625 .1 (.73)
Railway Age, 15 February, p. 431.
Thirteen-mile line breaks mountain barrier (Chevrolet-Hagans Connection). (4 400 words & fig.)

1930 621 .132.3 (.73)
Railway Age, 15 February, p. 437.
Pacific type locomotive for the Rutland. (900 words & fig.)

1930 625 .258 (.73)
Railway Age, 15 February, p. 439.
Car retarders facilitate car dumper operations (N. Y. C.). (400 words & fig.)

1930 624 .1 (.73)
Railway Age, Section one, 22 February, p. 464.
Excavate nine feet under the bottoms of old piers. (Toledo Terminal Railroad). (2 200 words & fig.)

1930 656 .255 (.73) & 656 .257 (.73)
Railway Age, Section one, 22 February, p. 468.
TAYLOR (C. A.). — Chesapeake and Ohio installs **new interlocking and either-direction signaling.** (1 900 words & fig.)

1930 656 .1 (.73) & 656 .2 (.73)
Railway Age, Section two, 22 February, p. 504.
Motor trucks extend railway service. (1 900 words & fig.)

1930 656 .1 (.73)
Railway Age, Section two, 22 February, p. 512.
SCHÖN (P.). — **Legislation affects motor transport progress.** (3 000 words & fig.)

1930 725 .31 (.73)
Railway Age, Section two, 22 February, p. 515.
New York's newest **terminal.** (1 000 words & fig.)

1930 656 .1 (.73) & 656 .2 (.73)
Railway Age, Section two, 22 February, p. 518.
MARRIOTT (G. W.). — Missouri Pacific Transportation Company sets record for rapid growth. In one year, a 4 000-mile system. (1 300 words & fig.)

1930 621 .33 (.3)
Railway Age, 1 March, p. 544.
SHEPARD (F. H.). — **Electrification of railroads** in prospect. (3 100 words & fig.)

1930 625 .245 (.73)
Railway Age, 1 March, p. 547.
North Western receives **five-horse-express cars.** (400 words & fig.)

1930 621 .138.5 (.71) & 725 .33 (.71)
Railway Age, 1 March, p. 549.
Canadian National builds large shop at Montreal. (5 000 words & fig.)

1930 621 .132.3 (.73)
Railway Age, 1 March, p. 559.
Fourteen 4-6-4 type locomotives for the Chicago, Milwaukee, St. Paul and Pacific. (700 words & fig.)

1930 621 .133.7 (.73)
Railway Age, 1 March, p. 567.
The **locomotive water conditioner.** (800 words & fig.)

1930 625 .232 (.73)
Railway Age, 8 March, p. 591.
Burlington equips new trains. (1 300 words & fig.)

1930 625 .27 (.73)
Railway Age, 8 March, p. 593.
CURTIS (D. C.). — The **reclamation and handling of track materials.** (1 700 words & fig.)

1930 625 .143.3 (.73)
Railway Age, 8 March, p. 595.
MORGAN (H. H.) and MOONEY (J. R.). — Why do intermediate manganese **steel rails fail?** (2 400 words, 2 tables & fig.)

1930 621 .133.1 (.73)
Railway Age, 8 March, p. 599.
Chicago & Eastern Illinois makes **locomotive fuel tests.** (2 100 words, 3 tables & fig.)

1930 621 .132.5 (.73)
Railway Age, 15 March, p. 635.
Freight locomotives (Mountain type) for the Bangor & Aroostook. (800 words & fig.)

1930 625 .1 (.73)
Railway Age, 15 March, p. 637.
Southern Pacific completes **new traffic link** (Alturas line). (1 700 words & fig.)

1930 656 .255 (.73)
Railway Age, 15 March, p. 640.
The Missouri Pacific installs **centralized signal control** on 43 miles of single line. (2 000 words & fig.)

1930 621 .138 (.73) & 656 .222 (.73)
Railway Age, 15 March, p. 643.
Long engine runs used effectively. Great Northern closes 14 terminals and increases **locomotive efficiency.** (1 300 words, 2 tables & fig.)

1930 625 .245 (.73) & 625 .246 (.73)
Railway Age, 15 March, p. 647.
Aluminium in tank car construction. (1 300 words & fig.)

1930 621 .135.1 (.73)
Railway Age, 15 March, p. 654.
Main **reservoirs in engine bed casing.** (200 words & fig.)

1930 621 .33
Railway Age, Section one, 22 March, p. 675.
DUER (J. V. B.). — Construction procedure for **electrification of railroads.** (2 700 words & fig.)

1930 625 .111 (.71)
Railway Age, Section one, 22 March, p. 681.
Canadian National plans **extensive improvements** at Montreal. (3 500 words & fig.)

1930 621 .132.3 (.436)
Railway Age, Section one, 22 March, p. 685.
GIESLINGEN (Dr. A.). — Austrian **2-8-4 locomotives** of unique design. Claimed to be the most powerful locomotive in Europe. Equipped with Lentz poppet valves. (3 100 words & fig.)

1930 625 .231
Railway Age, Section one, 22 March, p. 690.
LORENZ (M. O.). — Commodity valves and **freight rates.** (2 800 words.)

1930 659 (.42)
Railway Age, Section one, 22 March, p. 695.
DANDRIDGE (C. G.). — **Selling transportation** in Great Britain. (2 900 words.)

1930 656 .1 (.42) & 656 .2 (.42)
Railway Age, Section two, 22 March, p. 720.
ARTHURTON (A. W.). — **Rail motor coach-coordination** in Great Britain. (3 400 words & fig.)

1930 625 .232 (.73)
Railway Age, 29 March, p. 754.
Southern Pacific buys ten new **lounge cars.** (1 000 words & fig.)

1930 625 .13 (.73)
Railway Age, 29 March, p. 756.
HAGGANDER (G. A.). — Making old **bridges stronger.** (3 400 words & fig.)

1930 621 .33 (.73)
Railway Age, 29 March, p. 761.
WRIGHT (G. I.). — Reading installs **electric traction.** Three-wire, 33 000-volt distribution system. Cars equipped with 11 000-volt bus. (2 100 words & fig.)

1930 621 .134.3 (.73)
Railway Age, 29 March, p. 767.
Pacific type locomotive equipped with **poppet valves.** (600 words, 1 table & fig.)

Railway Engineering and Maintenance. (Chicago.)

1930 625 .164 (.71)
Railway Engineering and Maintenance, Febr., p. 50.
ALEXANDER (F. W.). — How the Canadian Pacific organizes its equipment and men to fight winter **snow.** (3 000 words & fig.)

1930 625 .175 (.73)
Railway Engineering and Maintenance, Febr., p. 54.
KNOWLES (C. R.). — What kind of (track) **motor cars?** (2 700 words & fig.)

1930 625 .122 (.73)
Railway Engineering and Maintenance, Febr., p. 58.
Protecting the track from mud slides. (1 200 words & fig.)

1930 625 .142.2 (.73) & 691. (.73)
ailway Engineering and Maintenance, Febr., p. 60.
Can timber be protected against decay? (5 800 words fig.)

1930 621 .133.7 (.73) & 725 .33 (.73)
ailway Engineering and Maintenance, Febr., p. 65.
BARDWELL (C. M.). — Treating plant removes 30 tons of mud. (1 800 words & fig.)

1930 625 .144.4 (.73)
ailway Engineering and Maintenance, March, p. 97.
Why neglect the section forces? (Labor saving uipment, Delaware, Lackawanna and Western). 2 400 words & fig.)

1930 625 .144.4 (.73)
ailway Engineering and Maintenance, March, p. 100.
What is the biggest problem in applying labor sav-g machines? (6 500 words & fig.)

1930 625 .144 (.73)
ailway Engineering and Maintenance, March, p. 107.
Keeping pace with progress in bridge and building uipment. (2 800 words & fig.)

1930 625 .144.4 (.73)
ailway Engineering and Maintenance, March, p. 110.
Boston and Maine ballasts 3 000 feet of track a day. 000 words & fig.)

1930 625 .144.4 (.73)
ailway Engineering and Maintenance, March, p. 114.
Crawler cranes prove versatile in maintenance work. 400 words & fig.)

1930 625 .144.4 (.73) & 625 .17 (.73)
ailway Engineering and Maintenance, March, p. 119.
Great Northern and Milwaukee turn to larger gangs. 700 words & fig.)

Railway Gazette. (London.)

1930 625 .13 (.42 + .44)
ailway Gazette, 31 January, p. 152.
The Channel tunnel. (1 500 words.)

1930 625 .13 (.42 + .44)
ailway Gazette, 31 January, p. 156.
GODFREY (E.). — A Channel tunnel? (5 700 words.)

1930 656 .255
ailway Gazette, 31 January, p. 160.
The operation of single lines of railway. — XXIX. 300 words.)

1930 313 .385.113 (.42)
ailway Gazette, 31 January, p. 162.
Railway operating statistics (1926-1927-1928). (1 400 rds & 5 tables.)

1930 656 .226 (.42)
Railway Gazette, 7 February, p. 189.
PAYNE (H. W.). — Transhipment traffic. (2 300 words & fig.)

1930 621 .87 (.42)
Railway Gazette, 7 February, p. 193.
Electric carriage hoists. (850 words & fig.)

1930 656 .255
Railway Gazette, 7 February, p. 194.
The operation of single lines of railway. — XXX. (1 800 words & fig.)

1930 621 .132.8 (.43) & 621 .43 (.43)
Railway Gazette, 7 February, p. 196.
New Diesel compressed-air locomotive. (500 words & fig.)

1930 621 .33 (.81)
Railway Gazette, 7 February, p. 197.
Electrification on the Oeste de Minas Railway of Brazil. (1 200 words & fig.)

1930 621 .132.8 (.54)
Railway Gazette, 14 February, p. 224.
New Beyer-Garratt locomotives for India. (1 000 words & fig.)

1930 656 .212.5 (.45)
Railway Gazette, 14 February, p. 229.
The new central station at Milan. (1 600 words & fig.)

1930 656 .1 (.54) & 656 .2 (.54)
Railway Gazette, 14 February, p. 234.
Indian railways and road competition. (3 500 words.)

1930 656 .234 (.42)
Railway Gazette, 21 February, p. 256.
A proposed new basis for railway passenger charges. (600 words.)

1930 625 .245 (.725)
Railway Gazette, 21 February, p. 261.
New rail motor car for the Mexican Railway Company. (800 words & fig.)

1930 656 .222.6 (.42)
Railway Gazette, 21 February, p. 267.
PAYNE (H. W.). — The Great Western Railway (Gt. Bn.) station truck system. (1 500 words & fig.)

1930 656 .234 (.42)
Railway Gazette, 21 February, p. 268.
FARRAR (M. E.). — A proposed new basis for railway passenger charges. (1 900 words.)

1930 656 .255
Railway Gazette, 21 February, p. 270.
The operation of single lines of railway. — XXXI. (1 400 words.)

1930 385 .4 (.42)
Railway Gazette, 28 February, p. 295.
Southern Railway (Gt. Bn.) **reorganisation.** (1 400 words.)

1930 656 .211.5 (.44)
Railway Gazette, 28 February, p. 298.
Automatic **platform gates** on the Paris Metropolitan Railway. (600 words & fig.)

1930 625 .616 (.86)
Railway Gazette, 28 February, p. 300.
New Kitson-Meyer **tank locomotive** for South America. (600 words & fig.)

1930 621 .95 (.42)
Railway Gazette, 28 February, p. 301.
A new **(drilling) machine** for railway shops. (750 words & fig.)

1930 385 .113 (.42)
Railway Gazette, 28 February, p. 314.
The « Underground » Group (1930). (3 600 words.)

1930 385 .113 (.42)
Railway Gazette, 28 February, p. 317.
Great Western Railway **meeting** (1930). (10 000 words).

1930 625 .616 (.83)
Railway Gazette, 7 March, p. 343.
New 2-6-2 **Diesel locomotive** for Chile. (1 100 words & fig.)

1930 621 .132.5 (.82)
Railway Gazette, 7 March, p. 345.
New 2-8-2 **compounds goods locomotives,** Central Argentine Railways. (800 words & fig.)

1930 625 .245 (.68)
Railway Gazette, 7 March, p. 346.
New bogie **cattle wagons,** South African Railways. (350 words & fig.)

1930 656 .255
Railway Gazette, 7 March, p. 348.
The **operation of single lines** of railway. — XXXII. (1 300 words & fig.)

1930 625 .13 (.42 + .44)
Railway Gazette, 7 March, p. 349.
CARVALHO (H. N.). — A Channel **tunnel?** (2 300 words.)

1930 656 .29
Railway Gazette, 7 March, p. 357.
Containers for international traffic (Rules and regulations of an **international competition** to determine the best container system). (1 900 words & fig.)

1930 385 .111 (.42)
Railway Gazette, 7 March, p. 359.
London Midland & Scottish Railway **meeting** (1930). (1 400 words.)

1930 385 .111 (.42)
Railway Gazette, 7 March, p. 369.
Southern Railway **meeting** 1930. (11 000 words.)

1930 625 .24 (.42)
Railway Gazette, 14 March, p. 390.
PAYNE (H. W.). — The **20-ton wagon in relation merchandise traffic.** (1 900 words & fig.)

1930 656 .211.7 (.42)
Railway Gazette, 14 March, p. 393.
New **steamships** for Channel Islands service, Southern Railway. (800 words & fig.)

1930 621 .335 (.82) & 621 .43 (.82)
Railway Gazette, 14 March, p. 394.
Diesel-electric traction in suburban work, Buenos Ayres Great Southern Railway. (1 400 words & fig.)

1930 656 .1 (.42)
Railway Gazette, 14 March, p. 400.
Road transport at the Railway Annual Meeting (Abstract of speeches by the Chairmen). (2 800 words)

1930 656 .1 (.68)
Railway Gazette, 14 March, p. 402.
South African **road motor competition** Commission (800 words.)

1930 385 .111 (.42)
Railway Gazette, 14 March, p. 415.
London & North Eastern **meeting** (1930). (12 000 words.)

1930 625 .13 (.42 + .44)
Railway Gazette, 21 March, pp. 438 and 449.
The Channel **tunnel** report. (3 900 words & fig.)

1930 625 .232 (.593)
Railway Gazette, 21 March, p. 444.
New **coaching stock** for the Siamese State Railway (1 100 words & fig.)

1930 385. (09.1 (.42)
Railway Gazette, 21 March, p. 447.
Paris-Lyons-Mediterranean Algerian Lines. (1 40 & map.)

1930 621 .132.8 (.62)
Railway Gazette, 28 March, p. 475.
New articulated **steam rail cars** for Egyptian State Railways. (3 000 words & fig.)

1930 656 .212.6 (.42)
Railway Gazette, 28 March, p. 479.
Mobile cranes for railway yards. (1 000 words & fig)

1930 621 .132.3 (.42)
Railway Gazette, 28 March, p. 481.
New **express locomotives,** Southern Railway. (4 words & fig.)

1930 656 .253 (.42)
ailway Gazette, 28 March, p. 482.
Electro-mechanical colour light signals. (2 500 words fig.)

1930 621 .132.5 (.42)
ailway Gazette, 28 March, p. 491.
New 0-6-0 type goods engine, Great Western Railway. 50 words & fig.)

1930 625 .245 (.42)
ailway Gazette, 4 April, p. 516.
A novel special vehicles train, London & North Eastn Railway. (1 000 words & fig.)

1930 625 .144 (.42)
ailway Gazette, 4 April, p. 518.
New London & North Eastern track laying machine. 500 words & fig.)

1930 621 .9 (.42)
ailway Gazette, 4 April, p. 520.
A new machine tool for railway shops. (Radial drilg, boring, tapping and studding). (2 300 words & g.)

1930 656 .222.1 (.71)
ailway Gazette, 11 April, p. 542.
The World's fastest train. (700 words & fig.)

1930 621 .132.8 (.946)
ailway Gazette, 11 April, p. 549.
Beyer-Garratt locomotives for Tasmania. (550 words fig.)

1930 621 .392 (.42)
ailway Gazette, 11 April, p. 550.
Electric welding in railway work. (1 200 words & r.)

1930 621 .335 (.494)
ailway Gazette, 11 April, p. 551.
7 200-H. P. **single-phase locomotive,** Swiss Federal ailways. (500 words & fig.)

1930 656 .255
ailway Gazette, 11 April, p. 553.
The operation of single lines of railway. XXXIII (Syx ngle line lock and block). (2 200 words & fig.)

1930 656 .1 (.42) & 656 .2 (.42)
ailway Gazette, 11 April, p. 556.
The railway-road situation reviewed. (4 400 words fig.)

1930 656 .1 (.42) & 656 .261 (.42)
ailway Gazette, 11 April, p. 559.
London Midland & Scottish Railway throughout nd transport of merchandise traffic. (700 words & .)

1930 625 .234 (.42)
ilway Gazette, No. 16, 18 April, p. 604.
An improved ventilator for passenger coaches and omotives. (600 words & fig.)

1930 621 .132.3 (.54)
Railway Gazette, No. 17, 25 April, p. 621.
Experimental **four-cylinder express locomotives,** Indian State Railways. (2 200 words & fig.)

1930 385. (09 (.67)
Railway Gazette, No. 18, 2 May, p. 677.
The **railways** of Tanganyika. (2 200 words, 1 table & fig.)

1930 385 .113 (.42)
Railway Gazette, No. 18, 2 May, p. 683.
Financial results of the Group Railway Companies in 1929. (2 000 words & tables.)

1930 656 .1 (.42)
Railway Gazette, No. 19, 9 May, p. 744.
The Eastern Counties **Road Car Company.** (2 000 words & fig.)

1930 621 .135.2 (.43)
Railway Gazette, No. 20, 16 May, p. 789.
An improved method of **cleansing railway axleboxes and other locomotive parts.** (900 words & fig.)

Railway Mechanical Engineer. (New York.)

1930 625 .26 (.73)
Railway Mechanical Enginee-, February, pp. 57 and 68.
Modern refrigerator repair shop Pacific Fruit Express Company plant at Roseville, Cal., fully equipped and organized for efficient operation. (1 900 words & fig.)

1930 621 .133.3 (.73)
Railway Mechanical Engineer, February, p. 62.
ROBBINS (F. S.). — **Flue mileage record of the Florida East Coast.** (1 000 words & fig.)

1930 621 .132.8 (.73)
Railway Mechanical Engineer, February, p. 65.
Milwaukee Mallets converted compound cylinders replaced by 21 1/2-in. single expansion cylinders — simplified steam pipe arrangement developed. (1 500 words & fig.)

1930 313 : 625 .2 (.73)
Railway Mechanical Engineer, February, pp. 69 and 79.
Large number of cars ordered in 1929 (121 117 freight and 2 425 passenger). (1 300 words & fig.)

1930 669 .1 (.73)
Railway Mechanical Engineer, February, p. 72.
FRY (Lawford, H.). — **Making steel for locomotive forgings.** (1 400 words & fig.)

1930 313 : 621 .132.1 (.73)
Railway Mechanical Engineer, February, p. 75.
Over twelve hundred locomotives ordered in 1929. (1 700 words & fig.)

1930 621 .133.2 (.73)
Railway Mechanical Engineer, February, p. 81.
ROESCH (F. P.). — **Stack loss and grates.** (1 300 words.)

1930 625 .232 (.73)
Railway Mechanical Engineer, February, p. 83.
Union Pacific buys new diners. (1 400 words & fig.)

1930 621 .392 (.73)
Railway Mechanical Engineer, February, p. 101.
FAIRCHILD (E. P.). — **Welding locomotive cylinders.** (700 words & fig.)

1930 621 .138.5 (.71)
Railway Mechanical Engineer, March, pp. 117 and 130.
Point St. Charles shops of the Canadian National. (2 800 words, 1 table & fig.)

1930 625 .216
Railway Mechanical Engineer, March, pp. 125 and 130.
RIPLEY (C. T.). — **Draft gears for passenger cars.** (1 800 words & figure.)

1930 621 .132.3 (.73)
Railway Mechanical Engineer, March, p. 127.
C. M. St. P. & P. purchases 4-6-4 type locomotives. (600 words, 2 tables & fig.)

1930 621 .133.1 (.73)
Railway Mechanical Engineer, March, pp. 131 and 144.
Screenings successfully burned in C. & E. I. road test. (2 200 words, tables & fig.)

1930 669 .1
Railway Mechanical Engineer, March, p. 136.
FRY (Lawford H.). — **Converting steel into locomotive forgings.** (3 500 words & fig.)

1930 621 .132.8 (08 (.73)
Railway Mechanical Engineer, March, p. 141.
Examples of recent articulated locomotives of various types. (1 table.)

1930 625 .235 (.73)
Railway Mechanical Engineer, March, p. 142.
WOOLLEN (A. H.). — **Aluminum alloys serve railroads.** (1 900 words & fig.)

1930 621 .138.5 (.73)
Railway Mechanical Engineer, April, pp. 181 and 201.
Missouri Pacific locomotive shop-standards plan. (1 400 words, 2 tables & fig.)

1930 621 .133.2 (.73)
Railway Mechanical Engineer, April, pp. 184 and 207.
ACKER (S. H.). — **Draft distribution in the firebox.** (3 000 words, 2 tables & fig.)

1930 621 .134.5 (.73)
Railway Mechanical Engineer, April, pp. 189 and 207.
Renovating oil and waste on the Delaware & Hudson. (2 700 words & fig.)

1930 625 .27 (.73)
Railway Mechanical Engineer, April, p. 195.
Seasoning wood at the Angus shops of the C. P. (2 700 words & fig.)

1930 385 .57 (.73) & 385 .586 (.73
Railway Mechanical Engineer, April, p. 200.
PARKER (L.). — **Selection of apprentices for th railway shop.** (570 words.)

1930 621 .132.5 (.73
Railway Mechanical Engineer, April, p. 203.
Wabash purchases twenty-five 4-8-2 type locomotive (1 150 words, 2 tables & fig.)

1930 625 .232 (.73
Railway Mechanical Engineer, May, p. 243.
« Yankee Clipper » train of the New Haven. (2 00 words, table & fig.)

1930 621 .132.3 (.73
Railway Mechanical Engineer, May, pp. 249 and 26
Great Northern buys 4-8-4 type locomotives. (60 words, 2 tables & fig.)

1930 625 .253 (.485
Railway Mechanical Engineer, May, p. 251.
Transit air brake tested on Swedish State Railway (1 300 words & fig.)

1930 385 .586 (.71
Railway Mechanical Engineer, May, pp. 254 and 26
HUMBER (M. A.). — **The Canadian National appren tice system.** (1 100 words, 1 table & fig.)

1930 621 .134.3 (.436
Railway Mechanical Engineer, May, p. 256.
GIESL-GIESLINGEN (A.). — **Austrian locomotiv equipped with poppet valves.** (2 400 words, 1 table fig.)

1930 313 : 621 .13 (.73
Railway Mechanical Engineer, May, p. 261.
Examples of recent three-cylinder locomotives various types. (1 table.)

1930 625 .25 (.73
Railway Mechanical Engineer, May, p. 262.
DOWN (S. G.). — **Air brakes play important part i transportation.** (2 300 words & fig.)

1930 625 .243 (.73
Railway Mechanical Engineer, May, p. 266.
Anatomy of a box car. (80 words & 1 plate.)

Railway Signaling. (Chicago.)

1930 656 .259 (.73
Railway Signaling, February, p. 41.
WESSON (E. G.). — **Burlington saves $ 6 440 a yea by remote-control interlocking.** (1 500 words & fig.)

1930 656 .256.3 (.73
Railway Signaling, February, p. 44.
Nickel Plate installs automatics. (1 800 words & fig

1930 656 .253 (.44)
ailway Signaling, February, p. 47.
Tape record checks observance of **cab signals.** (600 ords & fig.)

1930 656 .253 (.73)
ailway Signaling, February, p. 48.
MOLIS (B. W.). — Denver & Rio Grande installs ntralized **traffic control** on 32 miles of single track ie. (2 200 words & fig.)

1930 656 .259 (.73)
ailway Signaling, February, p. 51.
Automatic interlocker saves Wabash $ 5 000 a year. 500 words & fig.)

1930 656 .253 (.73)
ailway Signaling, February, p. 55.
Latest equipment features Philadelphia Subway gnaling. (4 300 words & fig.)

1930 656 .257 (.73)
ailway Signaling, February, p. 61.
The Rock Island develops unique interlocker **with no** echanical locking. (2 500 words & fig.)

1930 313 : 656 .25 (.73)
ailway Signaling, February, p. 65.
Interstate Commerce Commission issues annual **signal** atistics. (600 words & 2 tables.)

1930 625 .258 (.73) & 656 .254 (.73)
ailway Signaling, March, p. 83.
Car retarders save Michigan Central $ 400 a day. 300 words & fig.)

1930 656 .257 (.73)
ailway Signaling, March, p. 87.
THOMAS (G. K.). — Development of **automatic** terlockers on the Santa Fe. (5 000 words & fig.)

1930 656 .257 (.73)
ailway Signaling, March, p. 93.
New York Central makes rapid **cut-over** on large ant at Cleveland. (1 500 words & fig.)

1930 656 .257 (.73)
ailway Signaling, March, p. 95.
RICE (A. H.). — Delaware & Hudson installs unique terlocking arrangement for **switching layout.** (2 100 ords & fig.)

1930 656 .255 (.73)
ailway Signaling, March, p. 98.
Missouri Pacific installs centralized **signal control** 43 miles of single track. (2 800 words & fig.)

1930 656 .259 (.73)
ailway Signaling, March, p. 102.
Pennsylvania uses **remote control for switches.** (1 100 ords & fig.)

1930 656 .255 (.73)
ailway Signaling, March, p. 105.
Southern Pacific installs **centralized control** on sec- on of busy single track line. (2 200 words & fig.)

1930 656 .256
Railway Signaling, March, p. 108.
LORD (E. I.). — Advantages of **high voltage cells** for track circuits. (1 800 words & fig.)

South African Railways and Harbours Magazine. (Johannesburg.)

1930 385. (09.3 (.68)
South African Rys. and Harbours Mag., March, p. 378.
Forty years of railway service in South Africa. The career of Sir William Hoy, K. C. B. (2 000 words.)

1930 385. (09 (.59)
South African Rys. and Harbours Mag., March, p. 431.
THOMPSON (Wm.). — **Railways** of Indo-China. (2 500 words & fig.)

1930 659 (.42)
South African Rys. and Harbours Mag., March, p. 440.
DANDRIDGE (C. G.). — **Selling transport.** (3 200 words & portrait.)

In Spanish.

Ingenieria y Construccion. (Madrid.)

1930 625 .5
Ingenieria y Construccion, Abril, p. 183.
HUNZIKER (F.). — Una innovacion en la **construcción de funiculares.** (4 500 palabras & fig.)

1930 691
Ingenieria y Construccion, Junio, p. 281.
Investigaciones recientes sobre **fabricación de hormigones.** (6 300 palabras & fig.)

1930 625 .234
Ingenieria y Construccion, Junio, p. 290.
SANTIAGO (E.). — La calefacción en los **trenes eléctricos.** (4 100 palabras & fig.)

1930 385. (06.112 (.460)
Ingenieria y Construccion, Junio, p. 313.
La XI Sesión del Congreso Internacional de ferrocarriles. (23 000 palabras.)

Revista de Obras Públicas. (Madrid.)

1930 385. (09 (.460)
Revista de Obras Publicas, No. 7, 1° de Abril, p. 137.
Revista de Obras Publicas No. 8, 15 de Abril, p. 157.
Revista de Obras Publicas, No. 9, 1° de Mayo, p. 209.
Revista de Obras Publicas, No. 10, 15 de Mayo, p. 259.
MACHIMBARRENA (V.). — **La mejora y ampliación de la red ferroviaria española.** (13 000 palabras & fig.)

1930 385. (09.1 (.460)
Revista de Obras Publicas, No. 9, 1° de Mayo, p. 181.
Revista de Obras Publicas, No. 10, 15 de Mayo, p. 221.
Los ferrocarriles de España. (16 500 palabras, 4 cuadros & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1930 **624 .32 (.45)**

Annali dei lavori pubblici, febbraio, p. 97.

HANNAU (Vico). — **Il ponte metallico sul Garigliano per la Direttissima Roma-Napoli.** (3 000 parole & fig.)

1930 **624**

Annali dei lavori pubblici, marzo, p. 196.

BELLUZZI (O.). — **Il portale doppio dissimmetrico con i piedritti incastrati.** (4 500 parole & fig.)

1930 **624 .63 (.45)**

Annali dei lavori pubblici, aprile, p. 309.

SANTARELLA (L.). — **L'architettura nei ponti italiani in cemento armato.** (2 400 parole & fig.)

L'Ingegnere. (Roma.)

1930 **624 .63**

L'Ingegnere, Marzo, p. 172.

STABILINI (L.). — **Il calcolo dei ponti ad arco di cimento armato.** (2 700 parole & fig.)

1930 **624 .2**

L'Ingegnere, Maggio, p. 314.

ANTONINI (G). — **Momento massimo assoluto prodotto da un treno di carichi concentrati su una trave appoggiata agli estremi.** (5 000 parole & fig.)

1930 **691**

L'Ingegnere, Maggio, p. 320.

SERAO (V). — **Abachi per il calcolo di strutture inflesse in cemento armato.** (2 500 parole & fig.)

Notiziario Tecnico. (Firenze.)

1930 **625 .24 (.45)**

Notiziario Tecnico, Maggio, p. 164.

Veicoli di nuova costruzione delle Ferrovie dello Stato. (2 400 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1930 **624 .32 (.45)**

Rivista tecnica delle ferrovie ital., 15 marzo, p. 105.

FAVA (A.). — **Sul rinnovamento dei ponti metallici della rete delle Ferrovie dello Stato.** (10 000 parole & fig.)

1930 **313 .385**

Rivista tecnica delle ferrovie ital., 15 marzo, p. 141.

GIOVENE (N.). — **La statistica internazionale delle ferrovie e gli organismi che se ne occupano.** (3 000 parole & fig.)

1930 **625 .214 (.4**

Rivista tecnica delle ferrovie ital., 15 aprile, p. 153.

DEL GUERRA (G.). — **Perfezionamenti introdot dalle Ferrovie dello Stato alle boccole per veicoli.** (1 3 parole & fig.)

1930 **625**

Rivista tecnica delle ferrovie ital., 15 aprile, p. 16

ANASTASI (A.). — **Di alcuni punti del calcolo del configurazione delle funicolari aeree.** (3 700 parole fig.)

1930 **621 .535 (.4**

Rivista tecnica delle ferrovie ital., 15 maggio, p. 18

BIANCHI (G.) & ELENA (S.). — **I locomotori corrente continua a 3 000 volt gruppi E 625 ed E 62** (23 000 parole & fig.)

In Dutch.

Spoor- en Tramwegen. (Utrecht.)

1930 **625 .13 (.492**

Spoor- en Tramwegen, n^r 7, 1 April, p. 181.

COX (C. M.). — **Over het omhoogvijzelen van ee groote spoorwegbrug.** (2 400 woorden & fig.)

In Polish.

INŻYNIER KOLEJOWY. (Warszawa).

1930 **656 .1 & 656**

Inzynier Kolejowy, 1 Kwietnia, p. 119.

WASIUTYŃSKI (A.). — **Konkurencja ruchu samo chodowego.** (8 500 mots.)

In Portuguese.

Boletim do Instituto de Engenharia. (S. Paulo. (Brasil.)

1930 **625 .14 (0**

Boletim do Instituto de Engenharia, Fevereiro, p. 73 março, p. 148.

PINTO da Costa (Y. B.). — **Calculo da superstru tura das estradas de ferro pelo methodo do professo Kratchkovsky.** (7 400 palavras, 4 cuadros & fig.)

1930 **656 .211 (.81**

Boletim do Instituto de Engenharia, Maio, p. 284.

SIMOËS MAGRO (B.). — **A nova estaçao inicial d E. F. Sorocabana.** (8 700 palavras & fig.)

Revista das Estradas de Ferro. (Rio de Janeiro.

1930 **621 .138.5 (.81**

Revista das Estradas de ferro, n° 112, 15 de Março p. 94.

As novas officinas da Sorocabana para reparaçao d locomotivas. (1 100 palavras & fig.)

1930 **656 .211 (.81**

Revista das Estradas de ferro, n° 117, 30 de Maio, p. 20

A nova estaçao inicial da Sorocabana. (2 500 pala vras.)

9348. — Publisher : M. Weissenbruch Co., Ltd., Printer to the King, 49, rue du Poinçon, Brussels.

MONTHLY BIBLIOGRAPHY OF RAILWAYS [1].

PUBLISHED UNDER THE SUPERVISION OF

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(OCTOBER 1930)

016 .385. (02]

I. — BOOKS.

In French.

930 62. (01

AGON (E.), ingénieur des Arts et Manufactures, revu par M. P. CHAMBRAN.

ésistance des matériaux appliquée aux constructions. hodes pratiques par le calcul et la statique gra- ique, tome III.

aris (6e), Librairie Dunod, 92, rue Bonaparte. 1 vo- e (12 × 18 cm.), 584 pages. (Prix: broché, 56 francs.)

930 385. (02 (.44)

DFERNAUX (R.), ingénieur des Arts et Manufactures.

es grands réseaux de chemins de fer français, année 9.

aris (6e), Dunod, éditeur, 92, rue Bonaparte. Manuel poche (12 × 18 cm.).

930 621 .33

PLIMONT.

otes sur la traction électrique (fascicule II).

ruxelles, Editions de la Revue de l'Ecole polytech- ie. 1 volume in-4°, 80 pages. (Prix : 30 francs.)

930 347 .763.4

EVENEZ (René), d'HEROUVILLE (Maurice) et BLEYS (Etienne).

égislation des chemins de fer, tome I.

aris (5e), Librairie Arthur Rousseau, 14, rue Souf- et 13, rue Toullier. 1 volume (16 × 25 cm.), 627 es. (Prix : broché, 60 francs.)

930 721 .9

IBAULT (E.), ingénieur.

alculs simplifiés de stabilité des constructions en on armé à l'usage des entrepreneurs, dessinateurs, itectes.

aris (6e), Librairie Dunod, 92, rue Bonaparte. 1 vo- e (16 × 25 cm.) de 320 pages, 167 figures. (Prix : hé, 70 francs.)

In German.

1930 621 .133.1

BLEIBTREU (Hermann).

Kohlenstaubfeuerungen.

Berlin, Verlag Julius Springer. XI, 495 Seiten mit 267 Textabbildungen. (Preis : 39 Rm.)

1930 625 .142.2 & 625 .142.3

DIEHL (Dr. Ing.)

Zur Frage der Bewertung von Holz- und Eisenschwellen.

Berlin, V. D. I. Verlag, G. m. b. H. 58 Seiten mit 9 Abb. und 15 Zahlentafeln. (Preis : broschiert, 3.50 Rm.)

1929 656 .1 (.43)

EGERT.

Der Kraftwagen im Deutschen Verkehrswesen.

Halle (Saale), Verlag von Martin Boerner. (Preis : 6 Rm.)

1930 313 : 621 .33

ERTEL (A.).

Internationale Betriebsstatistik elektr. Bahnen für die Jahre 1924, 1925 und 1926. Aus dem Bericht über den IV. Internationalen Strassenbahn- und Kleinbahnkongress in Kopenhagen 1927.

Wien, XII/2, Graf-Seilern-Gasse 16. (Preis kart. : 6 Rm.)

1930 62. (01

FÖPPL (Dr. L.).

Aufgaben aus technischer Mechanik. (Statik, Festigkeitslehre, Dynamik.)

München und Berlin, Verlag von R. Oldenbourg. VIII, 188 Seiten. (Preis geh. : 13 Rm.; geb. : 15 Rm.)

1929 624 .63

GEHLER.

Balkenbrücken, Handbuch für Eisenbetonbau. 3 Aufl. Bd. 6. Erscheint in etwa 5 Lieferungen.

Berlin, Verlag Wilh. Ernst & Sohn. (Preis geheftet : 6.80 Rm. Für Bezieher der Zeitschrift Beton und Eisen : 6.20 Rm.)

[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by M. EISSENBRUCH in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1930 656 .25 (.43)

Kalender 1930 für das Sicherungs- und Fernmeldewesen der deutschen Reichsbahn Gesellschaft.

Berlin, Verlag H. Apitz, 184 Seiten. (Preis : 2.50 Rm.)

1930 621 .137.1

VIGENER (K.).

Hilfsbuch für Maschinisten und Heizer.

Leipzig, Verlag Hachmeister & Thal. Zwölfte, verbesserte Auflage, mit 258 Abbildungen. (Preis : 6.80 Rm.)

1930 656. (02

WIEDENFELD (Dr. K.).

Transportwesen. Grundriss der Nationalökonomik. Band 5, Abteilung : Transportwesen, Bankwesen und Handelswesen.

Tübingen, Verlag von Mohr & Siebeck. 4°, 140 Seiten.

In English.

1930 385 .13 (.71 + .73)

A brief survey of **railway taxation.**

Washington D. C. Published by Bureau of Railway Economics as Bulletin, special series No. 54. One pamphlet of 28 pages. Apply.

1930 62. (02 (.73)

American Civil Engineers' handbook. — Editor-in-Chief, Thaddens Merriman; Associate Editor-in-Chief, Thomas H. Wiggin. Fifth edition, thoroughly revised and enlarged.

New York, John Wiley & Sons. London, Chapman & Hall. Flexible; 4 1/2 × 7 inches; 2 263 pages; line cuts and tables. (Price : $ 8; or in two volumes, $ 10.)

1930 656 .256 (.73)

AMERICAN RAILWAY ASSOCIATION, SIGNAL SECTION.

American Railway Signaling principles and practices. Chapter XI. — **Alternating current track circuits.**

New York, N. Y. Published by the Signal Section, A. R. A. 30, Vesey Street. One pamphlet (6 × 11 inches) of 66 + 20 pages.

1930 656 .25 (06 (08 (.73)

AMERICAN RAILWAY ASSOCIATION, SIGNAL SECTION.

Minutes of Proceedings, 36th annual meeting, Chicago, 10 and 11 March 1930.

New York, N. Y. — Published by the Signal Section, A. R. A., 30, Vesey Street, April; No. 4. 1 vol. (6 × 11 inches) of 210 pages, illustrated.

1930 625 .142.2 (.73) & 691 (.73)

AMERICAN WOOD PRESERVERS ASSOCIATION.

Proceedings of the Twenty-sixth annual meeting of the Association, 28-30 January 1930. — **Index to Proceedings 1905-1929 inclusive.**

Washington D. C., American Wood Preservers Association, 1104, Chandler Building. 1 vol. (6 × 7 inches) of 542 pages with numerous illustrations and folding plates.

1930 625 .172 (.

A suggested program of **weed research and con**

Washington, Pub. Chamber of Commerce of the Un States, 27 pages.

1930

BLANCHARD (W. O.).

The geographic aspects of transportation.

New York City, Henry Holt & Co. 92 pages. (Pr $ 1.75.)

1930 621 .

BONE (William A.), NEWITT (Dudley M.) and TO NEND (Donald T. A.).

Gaseous combustion at high pressures.

London, Longmans, Green and Company, Limi (Price : 42 s. net.)

1930 656. (0 (

BRADY (H. G.).

A transportation glossary for students : terms phrases in common usage in Air, Highway, Railroad Ocean transportation and in port traffic.

New York, Simmons-Boardman Publishing Co. Fl ble; 5 × 7 inches; 105 pages. (Price : $ 1.75.)

1930 624.

Bridges : A study in their art, science and evolut illustrated with photographs and drawings of old new bridges in many lands.

New York, Pub. William Edwin Rudge. Cloth; 10 × inches; 36 pages; 400 illustrations, mostly halft views. (Price : $ 20.)

1930 385. (09 (.

BARRIGER (John W.)

The Pennsylvania Railroad.

New York, Pub. Calvin Bulloch. 88 pages. Illus tions, map. p. 43-44.

1930 51.

British Standard Conversion tables : Inches to m metres and millimetres to inches (No. 350 — 1930).

British Engineering Standards Association, 28, toria street, London, S. W. 1. (Price : 2 s. 2 d., free.)

1930 62. (01 (.

British standard specification for structural s for bridges and general building construction (B. S No. 15, 1930).

Published by the British Engineering Standards A ciation, 28, Victoria street, Westminster, Lon S. W. 1. (Price : 2 s. 2 d., post free.)

1929 62.

British standard specifications for steel plates, tions, bars and rivets for locomotives, carriages wagons for use in Railway rolling-stock (No. 24, pa 1929).

B. E. S. A. Publications Department, London, 28, toria street, S. W. 1. (Price : 2 s. 2 d., post free.)

1930 625 .212

British standard specification for tramway axles (No. 102, 1930).

The British Engineering Standards Association Publications Department, 28, Victoria street, Westminster, S. W. 1. (Price : 2 s. 2 d., post free.)

1930 621 .33 (06 (.73)

ELECTRIC RAILWAY JOURNAL.

Annual Convention and Exhibit number, American Electric Railway Association.

New York, N. Y. — Mc Graw-Hill Publishing Company Inc., Tenth Avenue at 36th Street. 1 vol. (8 3/4 × 12 inches), 72 pages with numerous illustrations. (Price : 50 c.)

1930 385 .31 (.73)

ELLINGWOOD (A. R.) and COOMBS (W.).

The Government and Railroad transportation.

Boston, Mass., published by Ginn & Co., 642 pages. (Price : $ 4.)

1930 385. (09.3 (.42)

ELLOWS (Reginald B.).

History of the Canterbury and Whitstable Railway.

Canterbury, J. A. Jennings Limited. (Price : 6 s. net.)

1930 38 & 656

ENELON (K. G.).

Transport co-ordination : A study of present-day transport problems.

London. P. S. King & Son, Orchard House, 14 Great Smith Street, Westminster, 1 vol., demy-8°, of 144 pages. (Price, cloth. : 6 sh.)

1930 625 .143

REEMAN (John R. Jr.) and WILLARD QUICK (G.).

Tensile properties of rail and some other steels at elevated temperatures.

Washington, D. C. Superintendent of documents. Research paper 164, reprint from Bureau of standards Journal of research. Vol. 4, April, 1930. Paper; 6 × 9 inches; 42 pages; line cuts, halftones and tables. (Price : 5 c.)

1930 385 (.73)

RODINSKY (J.).

Railroad consolidation — its economics and controlling principles.

New York City, D. Appleton & Co., 333 pages. (Price : $ 3.50.)

1930 697

ARDING (Allen Louis) and CUTTS WILLARD (Arthur).

Mechanical equipment of buildings.

New York, John Wiley & Sons, Incorporated. London, Chapman and Hall, Limited. Second edition. (Price : 30 s. net.)

1930 624. (02

OHNSTONE TAYLOR (F.).

Modern bridge construction.

London, Crosby Lockwood and Son, 7, Stationers' Hallcourt, E. C. 4. (Price : 15 s. net.)

1930 62. (01

LEIGH (Wilbur Charles) and MANGOLD (John, Frederic).

Practical mechanics and strength of materials.

New York and London : McGraw-Hill Book Co. Second edition. Cloth; 5 × 8 inches; 420 pages, 397 illustrations. (Price : $ 2.75.)

1930 656

LLOYD WILSON (G.).

Coordinated motor-rail-steamship transportation.

New York City, D. Appleton & Co. 228 pages. (Price : $ 3.50.)

1930 621 .13 (02

Locomotive engineers' pocket book.

London, Locomotive Publishing Company, Ltd., 3, Amen Corner, E. C. 4. (Price : 3 s. 6 d. net.)

1930 385. (09 (.83)

LONG (W. Rodney).

Railways of South America. Part III. — Chile Trade promotion series No. 93.

Washington D. C. — Published by U. S. Government Printing Office. 1 vol. of 373 pages with map and illustrations. (Price : $ 1.30.)

1930 62. (01

MOORE (Herbert F.).

A study of the Ikeda short-time (electrical resistance) test for fatigue strength of metals.

Urbana, University of Illinois. Paper; 6 × 9 inches; 34 pages; illustrations and tables. (Price : 20 c.)

1930 385 .517.6

OBLATH (Oscar).

Colour vision tests.

International Labour Office, Studies and Reports, F. 12. London : P. S. King & Son Ltd., Orchard House, Great Smith street, Westminster, S. W. 1. 47 pages. (Price : 2 s.)

1930 016. (385 (.73)

Railroad consolidation. — A List of References.

Washington, D. C., Bureau of Railway Economics. Special series No. 52, 83 pages. (Apply.)

1930 385 .586 (.73)

Standard railroad shop apprenticeship courses of instruction including shop assignment and related technical instruction units and regulation governing the issuance of standard credit cards and diplomas.

Fort Collins, Colo. Issued by the Colorado State Board for Vocational Education. 119 mimeo. p. (Apply.)

1930 621 .133.1

Technical data on fuel.

Second edition. Edited by E. M. Spiers. London : British National Committee World Power Conference, 63, Lincoln's Inn-fields, W. C. 2. (Price : 12 s. 6 d. net.)

1930 656 .2

The future of railroad transportation.

Washington, D. C. Published by Chamber of Commerce of the United States. 56 pages. (Apply.)

1929 656 .212.6

TOURNIER (Edward J.).

Materials handling equipment.

New York, McGraw-Hill Book Co. (Industrial Management series.). Cloth, 6 × 9 inches, 371 pages, illustrations, diagrams. (Price : $ 4.)

1929 621 .1

UEHLING (E. A.).

Heat loss analysis.

New York, McGraw-Hill Book Co. Cloth, 5 × 8 inches, 241 pages, diagrams, tables. (Price : $ 2.50.)

1930 347 .234 (.4

WAGHORN (Thomas).

The law relating to the compulsory taking of land public companies and local authorities.

Revised by R. Borregaard, M. A.

London : Effingham Wilson, 16, Copthall Avenu E. C. 2. 7 1/2 × 4 3/4 inches. 134 pages. (Price : 5

[016 .385. (05]

II. — PERIODICALS.

In French.

Annales des Mines. (Paris.)

1929 621 .118 (.44)

Annales des Mines, décembre, p. 510.

Bulletin des accidents d'appareils à vapeur survenus pendant l'année 1928 (d'après les dossiers soumis à l'examen de la Commission centrale des machines à vapeur). (Tableau & fig.)

Arts et Métiers. (Paris.)

1930 621 .116

Arts et Métiers, juin, p. 233.

PERREAU (L.). — Essai de contribution à l'étude des **tuyauteries de vapeur à haute pression.** (3 300 mots & fig.)

1930 624 .2

Arts et Métiers, juin, p. 242.

MARCOTTE (E.). — **Charges critiques dans les systèmes élastiques.** (1 200 mots.)

Bulletin de la Société d'encouragement pour l'industrie nationale. (Paris.)

1930 621 .43

Bull. de la Société d'encourag. pour l'industrie nationale, juin, p. 456.

DUMANOIS (P.). — Le **moteur Diesel** et les moteurs à combustibles lourds. (4 500 mots & fig.)

Bulletin de la Société des Ingénieurs civils de France. (Paris.)

1930 621 .4

Bull. de la Soc. des Ing. civ. de France, janv.-fév., p. 35.

GREBEL (A.). — De la conjugaison des qualités des **carburants** et des **moteurs à explosion.** (30 000 mots, 15 tableaux & fig.)

1930 669

Bull. de la Soc. des Ing. civ. de France, janv.-fév., p. 1

LE THOMAS (A.). — Les progrès récents des **fonte** moulées. (5 500 mots & fig.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1930 313 .385 (.4

Bull. des transp. intern. par ch. de fer, juin, p. 326.

Résultats de l'exploitation des chemins de fer l'Etat italien pour l'exercice 1928-29. (800 mots & 2 t bleaux.)

1930 313 .385 (.49

Bull. des transp. intern. par ch. de fer, juillet, p. 3

Statistique des chemins de fer suisses pour l'exerc 1928. (500 mots & tableau.)

Bulletin technique de l'Union professionnelle d inspecteurs techniques et des chefs de sectio des chemins de fer belges. (Bruxelles.)

1930 625 .1

Bull. techn. de l'Union profes. des insp. tech. et c chefs de section des ch. de fer belges, n° 40, 15 ju p. 1.

JONIAUX et LEFEBVRE. — Méthode pratique rapide de **rectification des courbes** de chemins de f (1 000 mots, tableaux & figure.)

Bulletin de l'Union internationale des chemi de fer. (Paris.)

1930 385 .113 (.4

Bull. de l'Union intern. des ch. de fer, juin, p. 199.

Les **chemins de fer** de l'Etat letton pendant l'exerc 1928-1929. (3 500 mots & 5 tableaux.)

1930 385 .113 (.497.1)
Bull. de l'Union intern. des ch. de fer, juin, p. 207.
Les **chemins de fer** de l'Etat yougoslave en 1927. (1 300 mots & 7 tableaux.)

1930 385 .113 (.43)
Bull. de l'Union intern. des ch. de fer, juin, p. 213.
Rapport du Commissaire des Chemins de fer allemands sur le **cinquième exercice de fonctionnement** de la Compagnie (1er janvier-31 décembre 1929). (12 000 mots & tableaux.)

Chronique des transports. (Paris.)

1929 385 .113 (.44)
Chronique des transports, n° 11, 10 juin, p. 7.
Les **résultats de l'exploitation** du réseau du Nord en 1929. (2 500 mots.)

Génie civil. (Paris.)

1930 691
Génie civil, n° 2498, 28 juin, p. 636.
Le **béton** vibré et pervibré. (3 000 mots.)

1930 62. (01
Génie civil, n° 2499, 5 juillet, p. 6.
SEIGLE (J.). — L'influence d'une forte torsion au rouge sur les **anomalies dilatométriques des aciers doux.** (3 000 mots & fig.)

1930 621 .335 (.82) & 621 .43 (.82)
Génie civil, n° 2499, 5 juillet, p. 9.
Les **locomotives Diesel-électriques** du « Great Southern Railway » de Buenos-Aires. (1 500 mots & fig.)

1930 669 .1
Génie civil, n° 2499, 5 juillet, p. 21.
Les moulages en **aciers spéciaux.** (1 100 mots & fig.)

1930 621 .133.7
Génie civil, n° 2501, 19 juillet, p. 53.
Pompes réchauffeurs et économiseurs, système Dabeg, pour l'alimentation de locomotives. (1 800 mots & fig.)

1930 625 .52 (.45)
Génie civil, n° 2501, 19 juillet, p. 68.
Les **tramways** à grande capacité et à marche rapide de Milan. (800 mots & fig.)

1930 725 (.460)
Génie civil, n° 2502, 26 juillet, p. 77.
CALFAS (P.). — Le **bâtiment central des téléphones,** à Madrid. (2 500 mots & fig.)

1930 621 .133.7
Génie civil, n° 2502, 26 juillet, p. 93.
L'épuration chimique des eaux par électrosmose. (1 000 mots & fig.)

La Science et la Vie. (Paris.)

1930 388 (.44) & 625 .6 (.44)
La Science et la Vie, juin, p. 508.
BODET (Jean). — **Comment on exploite les transports en commun** dans une grande ville moderne. (3 500 mots & fig.)

Les chemins de fer et les tramways. (Paris.)

1930 656 .212.6
Les chemins de fer et les tramways, juin, p. 107.
GUIRAUD (E.). — **Poste de triage** automatique. (1 100 mots & fig.)

1930 625 .143.2
Les chemins de fer et les tramways, juin, p. 111.
Procédé et appareil pour l'obtention d'une dureté uniforme de la **trempe du champignon de rails.** (1 000 mots & fig.)

1930 625 .143.5
Les chemins de fer et les tramways, juin, p. 112.
Dispositif d'ancrage destiné à empêcher le **cheminement des rails.** (2 500 mots & fig.)

1930 625 .144.4
Les chemins de fer et les tramways, juin, p. 114.
Machines à entailler et percer les traverses. (2 000 mots & fig.)

1930 625 .144.4
Les chemins de fer et les tramways, juin, p. 117.
Appareil pour le **bourrage du ballast.** (800 mots & fig.)

1930 625 .151
Les chemins de fer et les tramways, juin, p. 118.
Aiguillage sans coupure des rails de la voie principale. (400 mots & fig.)

1930 625 .62
Les chemins de fer et les tramways, juin, p. 118.
Jonction des contre-rails et des rails de raccordement dans les **aiguillages de tramways.** (600 mots & fig.)

1930 656 .281
Les chemins de fer et les tramways, juin, p. 120.
Plaque pour la remise sur rails de machines, tenders, voitures et wagons. (850 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1930 625 .62 (.44)
L'Ind. voies ferrées et transp. autom., juin, p. 98.
DAVID. — **Voitures motrices et remorques à caisses métalliques et à équipements multiples** des Tramways de Marseille. (Rapport présenté à la Ve Assemblée générale technique, Alger, janvier 1930.) (4 000 mots & fig.)

1930 625 .62

L'Ind. voies ferrées et transp. autom., juin, p. 115.

LEGRAND. — Emploi des métaux légers pour les garnitures de **voitures de transports en commun.** (Rapport présenté à la V^e^ Assemblée générale technique, Alger, janvier 1930.) (9 000 mots, 9 tableaux & fig.)

Revue générale des chemins de fer. (Paris.)

1930 621 .33 (.44)

Revue générale des chemins de fer, juin, p. 517.

LE TOUZÉ et TOURNEUR. — Note sur les installations fixes de **traction électrique** de la ligne de Culoz à Modane. (10 000 mots, 1 tableau & fig.)

1930 385 .587 (.44) & 625 .26 (.44)

Revue générale des chemins de fer, juin, p. 549.

LASSAIGNE. — L'emploi du **travail à la chaîne** dans les ateliers du matériel roulant de la Compagnie des Chemins de fer de l'Est. Note sur la **révision des bogies des voitures Est** aux ateliers de Noisy-le-Sec (suite). (500 mots & fig.)

1930 625 .24 (.44)

Revue générale des chemins de fer, juin, p. 554.

LESCOEUR. — La **transformation des wagons tombereaux** allemands en wagons à trémies aux ateliers de Romilly. (700 mots & fig.)

1930 625 .144.2

Revue générale des chemins de fer, juin, p. 559.

CHAPPELLET. — **Répartition des rails courts** employés dans les **courbes circulaires et les raccordements paraboliques** des chemins de fer. (2 500 mots, 2 tableaux & fig.)

1930 385 .113 (.493)

Revue générale des chemins de fer, juin, p. 571.

Les **résultats d'exploitation** du deuxième exercice (1928) de la Société Nationale des chemins de fer belges. (4 500 mots & 2 tableaux.)

1930 621 .133.2 & 621 .392

Revue générale des chemins de fer, juin p. 591.

Soudure des foyers en cuivre des locomotives. (800 mots & fig.)

1930 385 .517.6 (.44)

Revue générale des chemins de fer, juillet, p. 3.

RIVIÈRE (Dr. M.). — Les **dispensaires** créés à Bordeaux et à Toulouse par la Compagnie des Chemins de fer du Midi. (5 000 mots, 1 tableau & fig.)

1930 621 .133.7

Revue générale des chemins de fer, juillet, p. 22.

DURIN (H.). — **Réchauffeurs d'eau d'alimentation** à soutirage de vapeur. (3 000 mots & fig.)

1930 621 .392 (.43)

Revue générale des chemins de fer, juillet, p. 78.

Emploi de la **soudure** dans les ateliers de chemins de fer. (1 000 mots & fig.)

Revue Générale des Transports Automobiles et de l'automobile. (Pontoise.)

1929 656 .1 & 656 .2

Rev. gén. des transp. aut. et de l'autom., n° d'octobre.

PAHIN (L. A. H.). — **Concurrence ou collaboration** entre les **transports automobiles** sur routes et les **chemins de fer.** (750 mots.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1930 656 .235.5 (.43)

Archiv für Eisenbahnwesen, Mai-Juni, S. 571.

BAUSCH (Dr. Paul). — Der Rohstofftarif der deutschen Bahnen und seine wirtschaftliche Bedeutung (Schluss folgt). (9 500 Wörter und Tabellen.)

1930 385 .517 (.47)

Archiv für Eisenbahnwesen, Mai-Juni, S. 663.

WEHDE TEXTOR (Dr.). — Die Sozialversicherung in Russland. insbesondere der Eisenbahnarbeiter und Bediensteten. (8 200 Wörter.)

1930 385. (09 (.481)

Archiv für Eisenbahnwesen, Mai-Juni, S. 699.

WEILER. — **Verkehrsverhältnisse Norwegens.** (1 800 Wörter und 2 Karten.)

1930 656 .254 (.485)

Archiv für Eisenbahnwesen, Mai-Juni, S. 707.

WEILER. — **Sicherung von schienengleichen Wegübergängen in Schweden.** (700 Wörter und Abbildungen.)

1930 385 .113 (.493)

Archiv für Eisenbahnwesen, Mai-Juni, S. 711.

Die nationale Gesellschaft der belgischen Eisenbahnen im zweiten Geschäftsjahr (1. Januar bis 31. Dezember 1928). (Schluss.) (3 000 Wörter und Tabellen.)

1930 385 .113 (.436)

Archiv für Eisenbahnwesen, Mai-Juni, S. 730.

Die Eisenbahnen der Tschechoslowakischen Republik. (Nach dem Stand vom Jahr 1927 und 1928). (4 500 Wörter und Tabellen.)

1930 385 .113 (.62)

Archiv für Eisenbahnwesen, Mai-Juni, S. 760.

ROESNER (Dr. E.). — **Die Eisenbahnen in Ägypten** in den Rechnungsjahren 1923-24 bis 1927-28. (700 Wörter und Tabellen.)

1930 313 .385 (.52)

Archiv für Eisenbahnwesen, Mai-Juni, S. 779.

Die Eisenbahnen Japans im Rechnungsjahr 1926-27. (Tabelle.)

Elektrische Bahnen. (Berlin.)

930 621 .337
ktrische Bahnen, Juliheft, S. 201.
ENK (Hans). — **Uber die Adhäsion federnder Lokotiv-Einzelachsantriebe.** (2 800 Wörter und Abbildun-.)

930 621 .332 (.43)
ktrische Bahnen, Juliheft, S. 215.
SBECK (W.). — **Heizung der Fernleitungen** für die lesischen Gebirgsbahnen als Abwehr gegen Rauhreif. 00 Wörter und Abbildungen.)

Elektrotechnische Zeitschrift. (Berlin.)

930 621 .33 (.436)
ktrotechnische Zeitschrift, Heft 20, 15. Mai, S. 708.
IETHAMMER (F.). — **Die elektrischen Bahnen in tschechoslowakischen Republik.** (Schluss.) (3 000 rter und Abbildungen.)

930 621 .33 (.45)
ktrotechnische Zeitschrift, Heft 20, 15. Mai, S. 718.
ie **Elektrisierung der italienischen Bahnen.** (100 rter, Tabelle und Karte.)

930 656 .256.3
ktrotechnische Zeitschrift, Heft 21, 22. Mai, S. 741.
AMMERER (A.). — **Elektrische Zugbeeinflussing** h dem Code-System. (1 000 Wörter und Abbildun-.)

1930 621 .33 (.494) & 385 .1 (.494)
ktrotechnische Zeitschrift, Heft 29, 17. Juli, S. 1037.
ie **Wirtschaftlichkeit des elektrischen Betriebes** der weizerischen Bundesbahnen im Jahre 1929. (2 100 rter und Tabellen.)

1930 621 .335 (.82 + .83)
ktrotechnische Zeitschrift, Heft 30, 24. Juli, S. 1079.
ie **elektrischen Lokomotiven** der Transandine-Bahn. 00 Wörter und Abbildungen.)

Glasers Annalen. (Berlin.)

1930 621 .133.1
sers Annalen, Nr. 1272, 15. Juni, S. 151.
ROCKAT (Dr. Fr.). — **Beiträge zur Kohlenstaubge.** II. Abscheidung von Staub aus wagerechten Gasmen. (Fortsetzung). (1 700 Wörter, Tafeln und Abbilngen.)

1930 385 .113 (.43)
sers Annalen, Nr. 1272, 15. Juni, S. 154.
Aus dem **Geschäftsbericht** der Deutschen Reichsbahnsellschaft über das 5. Geschäftsjahr. (1. Januar bis Dezember 1929). (3 400 Wörter und Tabellen.)

1930 651 (.43)
sers Annalen, Nr. 1273, 1. Juli, S. 1.
SCHMELZER. — Die Seilpostanlage für den Aktenrkehr im Reichsbahn-Zentralamt, Berlin. (Schluss gt). (3 000 Wörter und Abbildungen.)

In English.

Bulletin American Railway Engineering Association. (Chicago.)

1930 385 .1 (.73) & 385 .3 (.73)
Bull. Amer. Ry. Eng. Ass^{on}, No. 326, June, p. 1.
DONNELLY. — **Railroad consolidation.** (2 000 words.)

1930 38
Bull. Amer. Ry. Eng. Ass^{on}, No. 326, June, p. 7.
DYER (G. W.). — The new industrial revolution. (4 200 words.)

1930 625 .143.2
Bull. Amer. Ry. Eng. Ass^{on}, No. 326, June, p. 16.
FREEMAN (J. R. Jr.) and FRANCE (R. D.). — The **endurance** properties of some special **rail steels.** (3 500 words, tables & fig.)

1930 385 .114 & 656 .2
Bull. Amer. Ry. Eng. Ass^{on}, No. 326, June, p. 40.
COBURN (M.). — The estimating of **changes in operating costs.** (1 000 words, 1 table & fig.)

Electric Railway Journal. (New York.)

1930 621 .338 (.73)
Electric Railway Journal, May, p. 248.
LOCKE (D. J.) and CLARK (A. T.). — Extensive **rolling stock rehabilitation** at Baltimore. (2 100 words, tables & fig.)

1930 625 .25 (.73)
Electric Railway Journal, May, p. 256.
DAVIS (H. A.). — **Air-magnetic brakes** make quick stops. (900 words & fig.)

1930 388 (.73)
Electric Railway Journal, May, p. 257.
CLARDY (W. J.). — Attaining **faster schedules in rapid transit service.** (1 800 words, tables & fig.)

1930 621 .338 (.73)
Electric Railway Journal, May, p. 267.
GRAHAM (R. N.). — Speedy, **light weight cars** placed in service in Youngstown (45 seated passengers — 28 800 lb.). (2 500 words & fig.)

1930 621 .332 (.73)
Electric Railway Journal, May, p. 281.
SCOTT (A. G.). — Use of **dynamometer successful in stringing trolley wire.** (1 000 words, 2 tables & fig.)

1930 388 (.43)
Electric Railway Journal, June, p. 304.
BRESLAUER (W.). — **Berlin transportation facilities coordinated.** (2 200 words, 6 tables & fig.)

1930 621 .31 (.73)
Electric Railway Journal, June, p. 311.
BAKER (C. E.). — **Mercury arc rectifiers** meet transportation demands. (3 200 words & fig.)

1930 621 .33 (06 (.73)
Electric Railway Journal, June, p. 326.
Program of San Francisco Convention, American Electric Railway Association. (1 500 words.)

1930 621 .33 (06 (.73)
Electric Railway Journal, July, p. 430.
Proceedings, 49th Annual Convention, American Electric Railway Association. — 23 to 26 June. (50 000 words, tables & figures.)

Engineer. (London.)

1930 669
Engineer, No. 3873, 4 April, p. 369.
SELWYN CASWELL (J.). — **The rolling of metals.** (Conclusion.) (4 000 words & table.)

1930 621 .132.8 (.42)
Engineer, No. 3873, 4 April, p. 371.
Super-pressure Schwartzkopff-Löffler locomotive. (2 000 words & fig.)

1930 621 .132.3 (.54)
Engineer, No. 3874, 11 April, p. 143.
North-Western Railway of India. — **Experimental four cylinder engines.** (300 words & fig.)

1930 621 .132.8 (.43) & 621 .4 (.43)
Engineer, No. 3877, 2 May, p. 487.
1 200 B. H. P. **Diesel-compressed air locomotive** for the German State Railways. (1 800 words & fig.)

1930 669
The Metallurgist, Supplement to the Engineer, No. 3881, 30 May, p. 66.
Abrasion. (1 100 words.)

1930 621 .335 (.54) & 621 .43 (.54)
Engineer, No. 3881, 30 May, p. 600.
Oil-electric locomotives for India. (2 700 words & fig.)

1930 621 .31
Engineer, No. 3881, 30 May, p. 613.
High-power mercury arc rectifiers. (1 200 words & fig.)

1930 621 .132.8 (.42)
Engineer, No. 3882, 6 June, p. 631.
The Kitson-Still locomotive. (1 900 words & fig.)

1930 625 .616 (.42)
Engineer, No. 3883, 13 June, p. 664.
A narrow-gauge geared steam locomotive. (900 words & fig.)

1930 621 .1
Engineer, No. 3883, 13 June, p. 666.
WEYLAND (G.). — **Centrifugal feed pumps for hig pressure boilers.** (2 000 words & fig.)

1930 624 .51 (.7
Engineer, No. 3884, 20 June, p. 676 and No. 3885, 27 Jun p. 705.
Montreal harbour bridge. (7 100 words & fig.)

1930 669
The Metallurgist, Supplement to the Engineer, No. 38 27 June, p. 87.
Tempering of mild steels containing copper. (2 0 words, tables & fig.)

1930 385. (0
Engineer, No. 3886, 4 July, p. 2.
PULLIN (W. E.). — **X-ray crystal analysis in e gineering.** (4 500 words & fig.)

1930 656 .235.5 (.4 + .7
Engineer, No. 3886, 4 July, p. 7.
GOOD (E. T.). — **Rail rates on iron and steel.** (1 0 words.)

1930 656 .28 (.42
Engineer, No. 3886, 4 July, p. 13.
An avoidable railway accident. (1 700 words.)

1930 621 .13 & 621 .3
Engineer, No. 3886, 4 July, p. 15.
Steam and electrically operated railways. (1 0 words.)

1930 625 .232 (.42
Engineer, No. 3887, 11 July, p. 43.
New twin « Royal Scot » **expresses.** (450 words fig.)

1930 621 .8
Engineer, No. 3887, 11 July, p. 45.
Five-ton portable crane operated by an oil engin (600 words & fig.)

1930 625 .245 (.42
Engineer, No. 3887, 11 July, p. 48.
Great Western Railway. — **120-ton railway trolle** (500 words & fig.)

1930 621 .13 (09
Engineer, No. 3888, 18 July, p. 56.
DENDY MARSHALL (C. F.). — **Links in the histo of the locomotive.** (4 500 words.)

1930 621 .132.8 (.42) & 621 .87 (.4
Engineer, No. 3889, 25 July, p. 102.
A light locomotive grab crane. (500 words & fig.)

1930 669
The Metallurgist, Supplement to the Engineer, No. 38 25 July, p. 100.
The quenching of steel. (1 800 words & fig.)

1930 669 .1
e Metallurgist, Supplement to the Engineer, No. 3889, 25 July, p. 106.
High chromium manganese steels. (1 000 words.)

Engineering. (London.)

1930 625 .13 (.54)
gineering, No. 3355, 2 May, p. 562.
The regirdering of the lower Sone bridge; East Indian ıte Railway. (5 500 words & fig.)

1930 621 .16
gineering, No. 3355, 2 May, p. 570.
Governor gear for high-speed reciprocating steam en-ıe. (1 200 words & fig.)

1930 624 .2
gineering, No. 3356, 9 May, p. 591.
VARWICK REYNOLDS (R.). — Simplified **formulæ** the design of reinforced concrete tee beams. (700 rds & fig.)

1930 625 .13 (.42)
gineering, No. 3357, 16 May, p. 645.
Replacement of the Folkestone harbour swing bridge. 00 words.)

1930 669 .1
gineering, No. 3357, 16 May, p. 653.
HAUGHTON (J. L.) and BECKER (M. L.). — The stitution of the **alloys of iron with silicon.** (2 500 rds, fig. & table.)

1930 621 .116
gineering, No. 3358, 23 May, p. 673.
Some modern **boiler problems.** (1 700 words.)

1930 625 .13 (.42)
gineering, No. 3359, 30 May, p. 696.
The replacement of a railway bridge at Liverpool. 0 words.)

1930 621 .132 (.62)
gineering, No. 3359, 30 May, p. 715.
Articulated steam rail coaches for the Egyptian State lways. (1 600 words & fig.)

1930 621 .18 (.43)
gineering, No. 3361, 13 June, p. 764.
Luths accumulator installation at Charlottenburg. 00 words & fig.)

1930 669
gineering, No. 3362, 20 June, p. 780; 27 June, p. 811.
ome alloys for use at high temperatures. (5 500 rds, tables & fig.)

1930 621 .86 (.42)
gineering, No. 3362, 20 June, p. 783.
ortable belt conveyor. (500 words & fig.)

1930 621 .335 (.44)
Engineering, No. 3362, 20 June, p. 793.
Tests on a A 5 400-H. P., 1 500-Volt electric locomotive. (600 words.)

1930 621 .116
Engineering, No. 3364, 4 July, p. 25.
ORROK (G. A.). — **The economics of high-pressure steam.** (1 500 words, tables & fig.)

1930 625 .245 (.42)
Engineering, No. 3365, 11 July, p. 42.
COLLETT (C. B.). — **120-ton crocodile wagon for transformers;** Great Western Railway. (700 words & fig.)

1930 669 .1
Engineering, No. 3365, 11 July, p. 56.
EVEREST (Arthur B.). — High-quality **cast-iron** in modern engineering practice. (4 300 words & fig.)

1930 621 .87 (.944)
Engineering, No. 3366, 18 July, p. 88.
70-ton breakdown cranes for the New South Wales Government Railways. (700 words & fig.)

Engineering News-Record. (New York.)

1930 625 .122
Engineering News-Record, No. 14, April 3, p. 547.
FRENCH (J. C.). — Development of the **dragline excavator.** A universal earth-moving tool. (1 500 words & fig.)

1930 624 .61 (.73)
Engineering News-Record, No. 15, April 10, p. 603.
HARDER (E. H.). — Ingenious **construction on Mill street bridge,** Watertown, N. Y. (1 100 words & fig.)

1930 625 .13 (.73)
Engineering News-Record, No. 16, April 17, p. 638.
Rim drilling and broaching used in driving and enlarging New York Central Railroad **tunnels.** (2 300 words & fig.)

1930 621 .392 (.438) & 624 .31 (.438)
Engineering News-Record, No. 16, April 17, p. 644.
STEFFAN BRYLLA. — The first **arc-welded bridge in Europe.** (800 words & fig.)

1930 625 .13 (.73) & 656 .211.5 (.73)
Engineering News-Record, No. 16, April 17, p. 652.
SAUNDERS (W. F.). — **Flat-slab concrete track deck** in St. Louis Union Station. (1 700 words & fig.)

1930 621 .392 (.73)
Engineering News-Record, No. 16, April 17, p. 656.
Welding symbols for the draftsman. (200 words & tables.)

1930 621 .392
Engineering News-Record, No. 17, April 24, p. 684.
Practices in flame-cutting of steel reported harmful. (1 400 words & fig.)

1930 **625 .13 (.73)**
Engineering News-Record, No. 17, April 24, p. 689.
Railroad **tunnel refloored** under traffic when walls settle. (1 200 words & fig.)

1930 **624 .51 (.73)**
Engineering News-Record, No. 18, May 1, p. 714.
SUNDERLAND (C. C.). — Manufacturing high-modulus **footbridge ropes** for Fort Lee Hudson river bridge. (2 800 words & fig.)

1930 **621 .392 (.06 (.73)**
Engineering News-Record, No. 18, May 1, p. 727.
Beam connection tests discussed at welding meeting. (1 700 words.)

1930 **385 & 656 .224**
Engineering News-Record, No. 19, May 8, p. 775.
Railroad improvement in relation to traffic capacity. (900 words.)

1930 **624 .52 (.73)**
Engineering News-Record, No. 20, May 15, p. 804.
PAINE (Clifford E.). — The 1 200-ft. **cantilever bridge** at Longview, Wash. (1 500 words & fig.)

1930 **021 .133.7 (.73)**
Engineering News-Record, No. 21, May 22, p. 843.
HOOVER (Charles P.). — Progress and trends in **water softening.** (1 600 words & fig.)

1930 **624 .32 (.73)**
Engineering News-Record, No. 22, May 29, p. 898.
End bearings of bridge allow for shifting of abutments. (1 300 words & fig.)

1930 **691 (.73)**
Engineering News-Record, No. 22, May 29, p. 902.
MUNSELL (A. W.). — **Preliminary studies and control of concrete** on port of New York authority work. (2 200 words, figures & table.)

1930 **624 .9 (.73)**
Engineering News-Record, No. 23, June 5, p. 935.
Novel combination and wood arch roof. St. Louis exhibition building 278 ft. wide includes steel cantilever trusses and framing at sides to carry central timber portion of 155 ft. span. (1 450 words & fig.)

1930 **693 (.73)**
Engineering News-Record, No. 25, June 19, p. 1002.
TILTON (Harold L.) and SAUNDERS (F. B.). — **Thin bridge floors concreted** in Vermont Winter. (2 400 words, tables & fig.)

1930 **625 .143.5 (.73)**
Engineering News-Record, No. 26, June 26, p. 1052.
Novel **track construction** in experimental service. (800 words & fig.)

1930 **62. (01 (.73 & 691 (.73)**
Engineering News-Record, No. 2, July 10, p. 58.
Cement, concrete and other materials at the A. S. T. M. meeting. (3 600 words & figure.)

1930 **624 .1 (.**
Engineering News-Record, No. 3, July 17, p. 89.
ALEXANDER (Randle B.). — Tubes in walls pe**pile driving** after concrete caisson is bottomed. (words & fig.)

1930 **62. (01 &**
Engineering News-Record, No. 3, July 17, p. 95.
SLATER (Willis A.) and INGE LYSE. — New se**of tests compares beam and control-cylinder stres** (1 100 words & fig.)

1930 **725 .33 (.**
Engineering News-Record, No. 4, July 24, p. 139.
KNOWLES (C. R.). — **Water-station reservoirs** the Illinois Central Railroad. (1 000 words & fig.)

1930 **624 (.**
Engineering News-Record, No. 5, July 31, p. 181.
Seven new Mississippi river **highway bridges.** (2 words & fig.)

Journal of the Institute of Transport. (Londo

1930 (
Journal of the Institute of Transport, April, p. 25
DAVIES (Ashton). — The **coordination of transp** (paper and discussion). (11 000 words.)

1930 **625 .62 & 65(**
Journal of the Institute of Transport, April, p. 26
WILKINSON (R. H.). — The advantages and lim**tions of the tramcar, railless vehicle, and motor** (paper and discussion). (11 000 words.)

1930 (
Journal of the Institute of Transport, May, p. 294.
STUART PILCHER (R.). — Some **transport proble** (6 000 words.)

1930 **656 .**
Journal of the Institute of Transport, May, p. 323.
KILLIN (R.). — The **block system of signall** (8 500 words.)

1930 (
Journal of the Institute of Transport, May, p. 335.
BELL (R.). — **Transport developments** in 1929. (7 words.)

1930 **656 .**
Journal of the Institute of Transport, June, p. 355.
HARE (T. B.). — **Dock capacity** (paper and dis**sion**). (12 000 words.)

1930 **385. (09.1 (.**
Journal of the Institute of Transport, June, p. 393.
CLOUGHER (N. M.). — The **Hudson Bay Railv** and Hudson Bay route. (3 000 words.)

Journal, Permanent Way Institution. (London.)

1929 **656 .211 (.42)**

Journal permanent way institution, part III, December, p. 235.

DOBSON (W. A.). — King's Cross **passenger station.** Alterations and improvements. March, 1927 and February, 1928. (3 600 words & folding plate.)

1929 **625 .62 (.42)**

Journal permanent way institution, part III, December, p. 245.

SHAW (Donald D.). — **Tramway permanent way.** (3 200 words & folding plate.)

1929 **625 .1 (.67)**

Journal permanent way institution, part III, December, p. 254.

COCK (H. G.). — **The instruction of the Tabora-Mwanza line,** Tanganyika Railways. (4 700 words & fig.)

Mechanical Engineering. (New York.)

1930 **385. (062 (.73)**

Mechanical Engineering, No. 5, April, p. 261.

RICE (Calvin W.). — **Fifty years of the American Society of Mechanical Engineers.** (13 000 words & fig.)

1930 **621. (09**

Mechanical Engineering, No. 5, April, p. 309.

Fifty years of Mechanical Engineering. A group of reports presenting the **history of technical development** since 1880, prepared by the professional divisions of the A. S. M. E. and their representatives. (See « Fifty years of transportation », p. 455.) (130 000 words, tables & fig.)

1930 **624 .51 (.73)**

Mechanical Engineering, No. 6, June, p. 587.

The Hudson river **suspension bridge.** (3 500 words & fig.)

1930 **621 .165**

Mechanical Engineering, No. 7, July, p. 673.

CHRISTIE (A. G.). — Economic considerations in the application of modern **steam turbines** to power generation. (To be concluded.) (5 300 words & fig.)

1930 **625 .143.5 (.73)**

Mechanical Engineering, No. 7, July, p. 718.

Track bolts and nuts. Proposed American standard. (300 words, tables & fig.)

Modern Transport. (London.)

1930 **656 .23 (.68)**

Modern Transport, 3 May, p. 10.

Railway rates in South Africa. Tariff amendments to meet road competition. (4 000 words & fig.)

1930 **656 .2**

Modern Transport, 10 May, p. 4; 26 July, p. 5.

HARE (T. B.). — Practical Railway Operation : Nos. 6 to 10 : **Terminals.** — Nos. 11 to 13 : Marshalling Yards. — Nos. 14 and 15 : Freight train working. — Nos. 16 and 17 : Freight train services. (30 000 words, tables & fig.)

1930 **621 .335**

Modern Transport, 17 May, p. 12.

GYSEL (E.). — Mechanical aspect of **electric locomotives.** The problem of the most efficient **drive.** (1 000 words.)

1930 **621 .335 (.54) & 621 .43 (.54)**

Modern Transport, 24 May, p. 13.

Oil-electric locomotives for India, to meet road competition. (1 500 words & fig.)

1930 **385. (09.1 (.71)**

Modern Transport, 31 May, p. 5.

BURTT (Philip). — **Across Canada.** Impressions of a transport authority. (1 500 words.)

1930 **347 .763.4 (.42)**

Modern Transport, 31 May, p. 17.

FENELON (K. G.). — Shortcomings of the **Road traffic Bill.** Defects which should be remedied. (3 000 words.)

1930 **385 .113 (.43)**

Modern Transport, 7 June, p. 5.

LEVERVE (G.). — **German Railways and Reparations.** Declining traffics, but obligations met (1929). (1 700 words.)

1930 **385 .113 (.67)**

Modern Transport, 14 June, p. 3.

Kenya and Uganda Railways and Harbours. Increased net receipt and successful **record of 1929.** (2 800 words & fig.)

1930 **385 .1 (.73)**

Modern Transport, 14 June, p. 5.

Railway progress in the United States. Effect of trade depression. (1 800 words & fig.)

1930 **621 .33 (.44)**

Modern Transport, 14 June, p. 13.

Electric locomotives in France. Tests on the Midi Railway. (1 500 words & fig.)

1930 **313 : 656.1 (.42)**

Modern Transport, 14 June, p. 19.

Railways and omnibus services. Need for reliable statistics. (1 000 words.)

1930 **621 .132.8 (.85)**

Modern Transport, 21 June, p. 3.

Three « Beyer-Garratt » **engines for standard gauge mountain railway in Peru.** (1 000 words & fig.)

1930 621 .33 (.42)

Modern Transport, 21 June, p. 11.

SMITH (Roger T.). — **Railway electrification** in Great Britain. An historical and practical review of existing conditions. (2 500 words, 1 table & fig.)

1930 625 .62 (.42)

Modern Transport, 21 June, p. 21.

EDWARDS (W. Vincent). — **Tramways superseded by trolley buses.** Factors affecting Hastings conversion. (3 400 words & fig.)

1930 625 .13 (0 (.43)

Modern Transport, 28 June, p. 9.

Locomotive experiments in Germany. Latest efforts to secure **operating economies.** (1 000 words.)

1930 656 .212 (.42)

Modern Transport, 28 June, p. 11.

Freight handling on the Great Western Railway. No. 6. — The new **goods depot** at Wolverhampton. (800 words & fig.)

1930 385 .3 (.73)

Modern Transport, 5 July, p. 3.

KIDD (Prof. Howard C.). — **Railway consolidation** in the United States. Present position reviewed (1 600 words.)

1930 656 .1 (.43) & 656 .2 (.43)

Modern Transport, 5 July, p. 4.

Railways and road transport. Competetive measures in Germany. (1 900 words.)

1930 625 .232 (.436)

Modern Transport, 5 July, p. 7.

All-steel coaches for Austrian Railways. Standard designs for international trains. (500 words & fig.)

1930 656 .1 & 656 .2

Modern Transport, 5 July, p. 10.

Road-rail transport. Device to enable rubber tyred vehicles to run on rails. (800 words & fig.)

1930 656 .1 (.42) & 656 .2 (.42)

Modern Transport, 5 July, p. 16.

Coordinating rail and road travel. How the public will benefit (Statement issued by the railway companies. (1 300 words.)

1930 625 .4 (.42)

Modern Transport, Scottish Congress section, 5 July, p. IX.

New system of **high-speed transport.** Experimental installation of the George Bennie « railplane ». (1 700 words & fig.)

1930 625 .232 (.42)

Modern Transport, 12 July, p. 3.

New **luxury coaches** on London Midland & Scottish Railway. New embellishments for « Royal Scot » services. (1 200 words & fig.)

1930 625 .14 (.436)

Modern Transport, 12 July, p. 5.

STRAUSS (F.). — New methods in railway construction. **Reinforced concrete and helical springs replace ballast and sleepers.** (1 700 words & fig.)

1930 656 .225 (.42)

Modern Transport, 12 July, p. 8.

Fruit and flowers by passenger train. Increasing traffic on the London & North Eastern Railway. (1 300 words & fig.)

1930 625 .245 (.42)

Modern Transport, 12 July, p. 9.

Transport of electric transformers on the Great Western Railway. **New 120-ton wagon** with detachable side beams. (700 words & fig.)

1930 656 .1 (.42) & 656 .2 (.42)

Modern Transport, Scottish Congress Section, 12 July, p. III.

Rail and road transport in Scotland. The present position reviewed. (2 500 words & fig.)

1930 656 .212 (.42)

Modern Transport, Scottish Congress Section, 12 July, p. IX.

An important Glasgow **terminal.** Hight Street **goods** station. (2 500 words & fig.)

1930 656 .254 (.42)

Modern Transport, Scottish Congress Section, 12 July, p. XI.

Train control on the London & North Eastern Railway. Arrangements in the Scottish Area. (2 300 words & fig.)

1930 656 .212 (.42)

Modern Transport, Scottish Congress Section, 12 July, p. XV.

London Midland & Scottish Railway **freight handling** in Glasgow. Buchanan Street **goods station.** (1 500 words & fig.)

1930 621 .132.3 (.54) & 621 .132.5 (.54)

Modern Transport, 19 July, p. 3.

British-built locomotives for Indian Railways. Standard **passenger and goods engines** for H. E. H. the Nizam 's Guaranteed State Railway. (900 words & fig.)

1930 621 .13, 621 .335 & 621 .43

Modern Transport, 19 July, p. 5.

Steam and Diesel-electric locomotives. Standards of comparison. (1 300 words & fig.)

1930 625 .4 (.43)

Modern Transport, 19 July, p. 13.

The Bavarian Zugspitze Railway. **Rack system** over heavy inclines. (2 500 words & fig.)

930 625 .26 (.42)
dern Transport, 19 July, p. 25.
LEMON (E. J. H.). — Railway **amalgamation** and its ect on the **workshops.** — Reorganisation. — Standisation. — Progressive construction. — Maintenance rolling stock (Paper presented to the Institute of nsport Congress, and discussion). (8 000 words &)

930 656 .1 (.42)
dern Transport, 19 July, p. 33.
THOMSON (William J.). — Long distance **omnibus** vices. Their place in the national scheme of transt. Abstract of paper presented to the Institute of nsport Congress, with discussion.) (7 500 words &)

930 656 .213
dern Transport, 19 July, p. 39.
UCHANAN (Sir George). — **Economics of port elopment. Methods of administration.** (Abstract of er presented to Institute of Transport Congress, h discussion.) (8 000 words & fig.)

930 621 .33 (.82)
dern Transport, 26 July, p. 3.
ailway electrification in South America. Sub-station trol on Central Argentine Railway. (2 000 words &)

oceedings, American Society of Civil Engineers. (New York.)

930 624 .2
ceed. Amer. Soc. Civil Eng., May, p. 919.
ROSS (Hardy). — **Analysis of continuous frames** by ributing fixed-end moments. (4 000 words, 1 table ig.)

930 624 (0 (.73)
ceed. Amer. Soc. Civil Eng., May, p. 1131.
eneral specifications for steel railway bridges pred by Committees from the American Society of il Engineers and the American Railway Engineering ociation. **(Discussion.)** (17 000 words, tables & fig.)

Proceedings, Institution of Civil Engineers. (London.)

929 624 .2
ceedings, Instit. of Civil Eng., Selected Engineering papers, No. 68.
ARTH (H. R.). — **Strainmeter tests of a railway lge.** (2 500 words, tables & fig.)

929 624 .1 & 721 .1
ceedings, Instit. of Civil Eng., Selected Engineering papers, No. 78.
IMM (Gower Bouverie Rayner). — The design of s. (4 000 words & fig.)

1929 624 .2
Proceedings, Instit. of Civil Eng., Selected Engineering papers, No. 80.
LOBBAN (Ch. H.). — Some **deflection problems.** (3 000 words, tables & fig.)

1929 624 (.68)
Proceedings, Instit. of Civil Eng., Selected Engineering papers, No. 81.
CLARK (W. H.). — **South African railway bridges :** Inspection and recalculation of existing bridges. (4 000 words, tables & fig.)

1929 624 .62
Proceedings, Instit. of Civil Eng., Selected Engineering papers, No. 82.
Adjustments for **temperature camber,** and deflection, and procedure for setting out during erection of the **steel arch bridge** across the Reond Nullah on the Kangra Valley Railway, India. (1 200 words, 1 table & fig.)

1930 624 .2 (01
Proceedings, Instit. of Civil Engineers, vol. 228, p. 46.
GRIBBLE (C.). — **Impact in railway bridges,** with particular reference to the report of the Bridge Stress Committee (paper and discussion). (43 000 words, tables & fig.)

1930 625 .4 (.42) & 725 .31 (.42)
Proceedings, Instit. of Civil Engineers, vol. 228, p. 157.
HALL (H.). — The new Piccadilly circus **station** (paper and discussion). (15 000 words & fig.)

1930 624 .32 (.54)
Proceedings, Instit. of Civil Engineers, vol. 228, p. 281.
COLAM (H. N.). — The **regirdering of the railway bridge** over the Krishna River, Madras and Southern Mahratta Railway, India; fourteen spans of 150 feet. — Author's reply to the discussion and correspondence. (3 600 words.)

1930 656 .1 (.42)
Proceedings, Instit. of Civil Engineers, vol. 228, p. 285.
MAYBURY (Sir Henry Percy). — Roads and **road transport.** (10 000 words & tables.)

Proceedings, Institution of Mechanical Engineers. (London.)

1929 536
Proceedings, Inst. of Mechan. Engineers, Nov., p. 811.
CALLENDAR (H. L.). — Critical **relations between water and steam.** (11 000 words, tables & fig.)

1929 621 .82
Proceedings, Inst. of Mechan. Engineers, Nov., p. 843.
HODGKINSON (F.). — **Journal bearing practice** (paper and discussion). (22 000 words, tables & fig.)

1929 621 .82
Proceedings, Inst. of Mechan. Engineers, Nov., p. 909.
CHARNOCK (Prof. G. F.). — **Bearings** for line shafting (paper and discussion). (30 000 words, tables & fig.)

1929 621 .13 & 669 .1
Proceedings, Inst. of Mechan. Engineers, Nov., p. 1069.
STANIER (W. A.). — The **heat treatment of locomotive parts.** (1 500 words & fig.)

1929 621 .13 & 669 .1
Proceedings, Inst. of Mechan. Engineers, Nov., p. 1087.
JOHNSON (W. A.). — **Alloy steels for locomotive construction.** (4 300 words, tables & fig.)

1930 621 .18 (.42)
Proceedings, Inst. of Mechan. Engineers, Jan., p. 73.
WATSON SMITH (E.). — General operation experiences with the first « Wood » steam generator (paper and discussion). (33 000 words, tables & fig.)

1929 621 .111
Proceedings, Inst. of Mechan. Engineers, Jan., p. 215.
Sixth report of the Steam-Nozzles Research Committee (paper and discussion). (22 000 words, tables & fig.)

Proceedings, Institution of Railway Signal Engineers. (London.)

1930 656 .25
Proceedings, Inst. of Ry. Signal Eng., Sept. 1929-Jan. 1930, Part II, p. 163.
MOORE (H. W.). — Specification, installation and maintenance of **power signalling systems** (paper and discussion). (5 600 words & fig.)

1930 621 .31
Proceedings, Inst. of Ry. Signal Eng., Sept. 1929-Jan. 1930, Part II, p. 184.
DOWNES (F. A.). — Some notes on **A. C. rectifiers** (paper and discussion). (10 000 words, tables & fig.)

1930 656 .253
Proceedings, Inst. of Ry. Signal Eng., Sept. 1929-Jan. 1930, Part II, p. 219.
DYER (H. H.). — Some further **electrical details of the Bow Road-Barking signalling** (paper and discussion). (9 000 words & fig.)

Railway Age. (New York.)

1930 656 .255 (.73)
Railway Age, No. 14, 5 April, p. 812.
ZANE (W. F.). — Burlington completes **centralized control system** on nine miles of double track. (1 000 words & fig.)

1930 725 .32 (.73)
Railway Age, No. 14, 5 April, p. 816.
Delaware, Lackawanna & Western builds large **terminal warehouse.** (2 900 words & fig.)

1930 621 .132.5 (.73)
Railway Age, No. 14, 5 April, p. 821.
Mountain type locomotives for the Wabash. (700 words, 1 table & fig.)

1930 385 .4 (.
Railway Age, No. 14, 5 April, p. 823.
Operating 1 000 mile-divisions. (1 200 words, 2 ta & fig.)

1930 621 .33 (.
Railway Age, No. 14, 5 April, p. 825.
COORS (W. F.). — Maintenance of steam railr **electrification equipment.** (1 500 words.)

1930 625 .232 (.
Railway Age, No. 15, 12 April, p. 854.
New Haven **Deluxe train service** between New Y and Boston. (1 100 words & fig.)

1930 656 .212.6 (.
Railway Age, No. 15, 12 April, p. 857.
What railroads are doing with **tractors.** (3 000 wo & fig.)

1930 621 .138.2 (.
Railway Age, No. 15, 12 April, p. 865.
An efficient **coaling plant.** (700 words & fig.)

1930 669
Railway Age, No. 15, 12 April, p. 867.
SHEEHAN (W. M.). — The **steel founders' contri tion** to the railroads. (1 300 words & fig.)

1930 621 .335 (.
Railway Age, No. 16, 19 April, p. 911.
KIMBALL (R. L.). — **Electric locomotive** built railroad. (1 000 words, 1 table & fig.)

1930 656 .22
Railway Age, No. 16, 19 April, p. 913.
FOOTE (J. W.). — Graphic charts for **operating p blems.** (1 100 words & fig.)

1930 625 .244 (.
Railway Age, No. 16, 19 April, p. 921.
Iceless refrigerator and heater car. (900 words & fi

1930 656 .211.5 (.
Railway Age, No. 17, 26 April, Section one, p. 954
Country's largest **trainshed** expanded 60 per ce (3 000 words & fig.)

1930 625 .3 (.
Railway Age, No. 17, 26 April, Section one, p. 959
Mountain operations move smoothly. (1 300 words fig.)

1930 621 .139 (.73), 625 .18 (.
& 625 .27 (
Railway Age, No. 17, 26 April, Section one, p. 961
Specification. — The tap root of New York Cent buying. (2 200 words & fig.)

1930 621 .132.3 (.
Railway Age, No. 17, 26 April, Section one, p. 965
4-8-4 type locomotives for passenger service. (words, 1 table & fig.)

1930 385 .21 (.73)
Railway Age, No. 17, 26 April, Section one, p. 969.
MORSE (C. A.). — **Inland waterways** will shorten length of rail haul. (2 100 words.)

1930 385 .3 (.73)
Railway Age, No. 17, 26 April, Section one, p. 972.
LANE (H. F.). — Hearings on Couzens resolution. Proposal to stop all **railway unifications** arouses much controversy. (5 400 words.)

1930 347 .763 (.73) & 656 .1 (.73)
Railway Age, No. 17, 26 April, Section two, p. 1009.
LANE (H. F.). — **Motor coach bill** before Senate. (3 000 words.)

1930 656 .1 (.73) & 656 .261 (.73)
Railway Age, No. 17, 26 April, Section two, p. 1014.
Operating a **co-ordinated rail-motor truck service.** (1 700 words & fig.)

1930 656
Railway Age, No. 17, 26 April, Section two, p. 1027.
OGDEN (G. D.). — **Co-ordinated transportation.** (2 500 words.)

1930 656 .254 (.71)
Railway Age, No. 18, 3 May, p. 1053.
Phone service on moving trains. (1 000 words & fig.)

1930 725 .32 (.73)
Railway Age, No. 18, 3 May, p. 1055.
Reading building year's biggest **storehouse.** (1 000 words & fig.)

1930 656 .255 (.73)
Railway Age, No. 18, 3 May, p. 1058.
CORFIELD (R. J.). — The Bingham & Garfield installs **centralized control system.** (1 000 words & fig.)

1930 621 .335 (.73)
Railway Age, No. 18, 3 May, p. 1060.
McGEE (P. A.). — **Electric switching and transfer locomotives.** (1 400 words, 2 tables & fig.)

1930 625 .142.2 (.73)
Railway Age, No. 18, 3 May, p. 1063.
WARNE (C. C.). — The future of **crosstie** buying. (1 500 words & fig.)

1930 625 .142.2 (.73)
Railway Age, No. 18, 3 May, p. 1073.
TOWNER (M. E.). — **Tie buying** has changed. (1 300 words.)

1930 657. (06 (08 (.73)
Railway Age, No. 19, 10 May, p. 1114.
Accountants hold lively session. (7 500 words.)

1930 625 .142.2 (.73) & 691 (.73)
Railway Age, No. 19, 10 May, p. 1122.
The changing **crosstie.** (6 500 words & fig.)

1930 621 .133.1 (06 (08 (.73)
Railway Age, No. 19, 10 May, p. 1131.
Fuel performance best index of operating efficiency. (5 000 words, 4 tables & fig.)

1930 313 : 656 .286 (.73)
Railway Age, No. 19, 10 May, p. 1137.
Grade crossing accidents. (1 300 words.)

1930 656 .253 (.73)
Railway Age, No. 20, 17 May, p. 1174.
BENDER (F. W.). — New Jersey Central installs **cab signalling** on single track without permissive wayside signals. (1 200 words & fig.)

1930 621 .133.1 (06 (08 (.73)
Railway Age, No. 20, 17 May, p. 1177.
Attendance at **Fuel convention** exceeds expectations. (4 500 words & fig.)

1930 656 .23 (0
Railway Age, No. 20, 17 May, p. 1183.
AUSTIN (W.). — How to forecast the **volume of traffic.** (1 600 words, 3 tables & fig.)

1930 625 .253. (06 (08 (.73)
Railway Age, No. 20, 17 May, p. 1193.
Convention discusses **air-brake operation** and maintenance. (1 600 words.)

1930 625 .232. (09
Railway Age, No. 20, 17 May, p. 1195.
Many changes in **Pullman cars** since 1858. (1 300 words & fig.)

1930 621 .132.3 (.73), 621 .132.5 (.73) & 621 .135.2 (.73)
Railway Age, No. 21, 24 May, Section one, p. 1225.
A 4-8-4 type demonstration locomotive for Timken. (2 200 words, 1 table & fig.)

1930 625 .143.1 (.73)
Railway Age, No. 21, 24 May, Section one, p. 1231.
What is the **economic weight of rail?** (4 500 words, 12 tables & fig.)

1930 691 (.73)
Railway Age, No. 21, 24 May, Section one, p. 1241.
MEYERS (R. E.). — Developments in the **creosoted pole industry.** (1 200 words, 2 tables & fig.)

1930 656 .22 (.73)
Railway Age, No. 21, 24 May, Section one, p. 1247.
Daily records aid operations. (1 400 words & fig.)

1930 656 .1 (.73)
Railway Age, No. 21, 24 May, Section one, p. 1248.
I. C. C. to inquire into **motor transportation.** (1 400 words.)

1930 656 .1 (.73)
Railway Age, No. 21, 24 May, Section two, p. 1267.
Regulation of motor coach lines operating interstate again put off. (900 words.)

1930 656 .1 (.73)
Railway Age, No. 21, 24 May, Section two, p. 1270.
HUFFMAN (T. E.). — **Winning traffic back from the truck lines.** (1 300 words & fig.)

1930 656 .261 (.73)
Railway Age, No. 21, 24 May, Section two, p. 1274.
Dispatching plan of motor haulage. (1 300 words & fig.)

1930 656 .1 (.73)
Railway Age, No. 21, 24 May, Section two, p. 1283.
Santa Fe expands « Detour » **highway service.** (800 words & fig.)

1930 656 .1 (.73) & 656 .261 (.73)
Railway Age, No. 21, 24 May, Section two, p. 1285.
WILLIAMS (H. G.). — Why not **store door delivery?** (2 500 words.)

1930 625 .14 (.73)
Railway Age, No. 22, May 31, p. 1305.
CHIPMAN (Paul). — Is our present **roadbed construction ideal?** (2 400 words & fig.)

1930 656 .212.6 (.73)
Railway Age, No. 22, May 31, p. 1313.
MILLER (J. V.). — Reducing railway material handling costs. (900 words & fig.)

1930 656 .1 (.73)
Railway Age, No. 22, May 31, p. 1315.
LINNEHAN (W. L.). — Rock Island extends use of **tabulating machines.** (900 words & fig.)

1930 625 .242 (.73)
Railway Age, No. 22, May 31, p. 1323.
Sixty-five foot **gondola cars** for the Bessemer. (400 words & fig.)

1930 621 .138 (.73) & 721 .33 (.73)
Railway Age, 7 June, p. 1358.
Toronto, Hamilton & Buffalo builds fireless **engine house.** (3 700 words & fig.)

1930 656 .237 (.73)
Railway Age, 7 June, p. 1364.
How the Illinois Central does its **buying.** (3 000 words & fig.)

1930 625 .232 (.73)
Railway Age, 7 June, p. 1371.
North Coast Limited **trains newly equipped.** (800 words & fig.)

1930 621 .133.7
Railway Age, 7 June, p. 1379.
Water supply problems are varied. (3 000 words & fig.)

1930 656 .22 (.73)
Railway Age. 7 June, p. 1383.
Boosting coach travel has its limits. (1 600 words & fig.)

1930 625 .162 (.73)
Railway Age, 7 June, p. 1387.
Protection of railway grade crossings. Report adopted at third national conference on street and highway safety. (4 000 words & tables.)

1930 621 .332 (.73)
Railway Age, 14 June, p. 1408.
Catenary system for the Lackawanna **electrification.** (2 500 words & fig.)

1930 625 .13 (.73)
Railway Age, 14 June, p. 1412.
BEBB (J. E.) and ALEXANDER (L. B.). — Old **iron viaduct** retired after 46 years. Metal towers replaced by **concrete piers.** (1 500 words & fig.)

1930 621 .13 (.73)
Railway Age, 14 June, p. 1419.
ANDERSON (R. W.). — Five years' **developments in locomotive service** (reduced maintenance costs and improved performance) on the Chicago, Milwaukee, St. Paul & Pacific. (2 700 words & fig.)

1930 621 .335 (.73) & 621 .43 (.73)
Railway Age, 14 June, p. 1427.
BROWN (A. R.). — An 800-horsepower **oil-electric locomotive.** (2 000 words, 1 table & fig.)

1930 624 .32 (.73)
Railway Age, Section one, 21 June, p. 1458.
KIRKBRIDE (W. H.). — Novel **construction methods used** on Suisun Bay **bridge.** (5 100 words & fig.)

1930 625 .162 (.73)
Railway Age, Section one, 21 June, p. 1473.
GALLOWAY (Ch. W.). — **Grade separation.** — Is it the solution for **crossing accidents?** (2 200 words & fig.)

1930 656 .1 (.73)
Railway Age, Section two, 21 June, p. 1509.
Within four years, tremendous increase in **motor transport activities of railways** since inception of Motor Transport Division of American Railway Association. (4 000 words.)

1930 656 .1 & 656 .24
Railway Age, Section two, 21 June, p. 1519.
KIMBALL (D. H.). — **Co-ordinating railway and motor coach claim work.** (2 400 words.)

1930 656 .1 (.42) & 656 .2 (.42
Railway Age, Section two, 21 June, p. 1523.
ARTHURTON (A. W.). — **Rail-motor truck co-ordination** in Great Britain. (3 500 words & fig.)

1930 656 .211 (.73) & 725 .31 (.73)
Railway Age, 28 June, p. 1552.
LACHER (Walter S.). — Cleveland **Terminal Station.** Electrification, air rights developments and many innovations in design feature great terminal just completed. (22 000 words & fig.)

1930 625 .245 (.73)
Railway Age, 28 June, p. 1581.
New **dynamometer car** placed in service on the Chicago, Milwaukee, St. Paul & Pacific. (2 500 words & fig.)

1930 625 .258 (.73)
Railway Age, 28 June, p. 1584.
The Pennsylvania installs **car retarders** in Pitcairn Yard, near Pittsburgh, Pa. (2 500 words & fig.)

1930 656 .2 (06 (08 (.73)
Railway Age, June 1928, p. 1587.
Superintendents' 37th annual convention at Minneapolis. (10 000 words & fig.)

1930 385 (09.1 (.43)
Railway Age, July 5, p. 4.
LAYNG (Ch.). — **Rebuilding a nation's railways (Germany).** (2 000 words & fig.)

1930 62. (01 (06 (.73)
Railway Age, July 5, p. 8.
American Society for Testing Materials holds annual meeting. (3 300 words & fig.)

1930 385 .114 (.73)
Railway Age, July 5, p. 17.
LORENZ (M. O.). — Territorial **variation in cost of service.** (3 600 words & tables.)

1930 385 .4 (.42 + .73)
Railway Age, July 5, p. 23.
BELL (R.). — An Englishman looks at **Railways of the United States.** (3 500 words.)

1930 625 .143.1
Railway Age, July 5, p. 23.
STEVENS (J. F.). — What is the economic **weight of rail?** (1 400 words.)

1930 614 .8 (.73)
Railway Age, 12 July, p. 50.
Safety section to set new goal. (Program of annual meeting at Denver and abstracts of papers presented.) (7 000 words & fig.)

1930 625 .231 (.73)
Railway Age, 12 July, p. 59.
Rock Island gets fifty modern **caboose cars.** (1 400 words & fig.)

1930 625 .13 (.73)
Railway Age, 12 July, p. 61.
Daylighting a 1 400-foot **tunnel.** (700 words & fig.)

1930 625 .246 (.73)
Railway Age, 12 July, p. 62.
Light-weight **concrete car floor** tested. (700 words & fig.)

1930 656 .223.2 (.73)
Railway Age, 12 July, p. 63.
PATTERSON (G. E.). — How New York Central increased **average car load.** (2 100 words & fig.)

1930 621 .133.8 (.73)
Railway Age, 12 July, p. 67.
WALSH (J. L.). — Missouri-Kansas-Texas tests efficiency of **whistle.** (1 400 words, 2 tables & fig.)

1930 656 .255 (.73)
Railway Age, 19 July, p. 98.
Centralized traffic control on the Southern Pacific. (3 800 words & fig.)

1930 725 .34 (.73)
Railway Age, 19 July, p. 103.
DILLENBECK (Clark). — Reading builds huge **commercial building** at Philadelphia, Pa. (2 700 words & fig.)

1930 625 .211 (.73) & 625 .216 (.73)
Railway Age, 19 July, p. 107.
The Duryea **cushion underframe** (Baltimore & Ohio). (2 900 words & fig.)

1930 621 .139 (.73) & 625 .27 (.73)
Railway Age, 19 July, p. 111.
Materials inspection stressed on New York Central. (4 300 words & fig.)

1930 614 .8 (.73)
Railway Age, 19 July, p. 117.
JEFFERS (W. M.). — Knowledge essential for **safety.** (2 400 words.)

1930 621 .132.5 (.73)
Railway Age, Section one, 26 July, p. 143.
Third **high-pressure locomotive** on the Delaware & Hudson. (2 100 words & fig.)

1930 621 .335 (.73)
Railway Age, Section one, 26 July, p. 148.
ARTHUR (W.). — **Heavy electric traction** tendencies in the United States. (3 000 words.)

1930 656 .212.6 (.73)
Railway Age, Section one, 26 July, p. 151.
HUNKER (W. L.). — **Tractors** pay on the Rock Island. (1 200 words & fig.)

1930 614 .8 (.73)
Railway Age, Section one, 26 July, p. 153.
WHITNEY (A. F.). — **Safety** progress due to relations of employers and men. (3 000 words.)

1930 697
Railway Age, Section one, 26 July, p. 161.
How research resulted in a new roof **ventilator.** (800 words & fig.)

1930 313 : 625 .162 (.73) & 656 .1 (.73)
Railway Age, Section one, 26 July, p. 163.
The **grade crossing** and motor vehicle situation. (700 words & table.)

1930 669
Railway Age, Section one, 26 July, p. 164.
New structural shapes from **aluminum alloys.** (1 600 words & fig.)

1930 656 .1 (06 (08 (.73)
Railway Age, Section two, 26 July, p. 184.
Motor Transport Division of the American Railway Association holds best meeting. — **Proceedings.** (12 000 words & fig.)

1930 656 .1 (.73)
Railway Age, Section two, 26 July, p. 198.
Interstate Commerce Commission issues **motor transport questionnaire.** (2 800 words.)

1930 656 .1 (.73) & 656 .261 (.73)
Railway Age, Section two, 26 July, p. 201.
GRAY (Carl R. Jr.). — **One railroad's answer to the truck question.** (2 400 words.)

Railway Engineer. (London.)

1930 625 .1 (.42)
The Railway Engineer, No. 603, April, pp. 135 & 160.
New Wimbledon and Sutton line, Southern Railway. (2 500 words, folded plate & fig.)

1930 621 .132.3 (.43)
The Railway Engineer, No. 603, April, p. 143.
Ultra high-pressure locomotive, German Railways. (2 400 words & fig.)

1930 625 .32 (.68)
The Railway Engineer, No. 603, April, p. 148.
New first-class **sleeping coaches,** Rhodesia Railways. (1 100 words & fig.)

1930 385 .4 (.42) & 625 .1 (.42)
The Railway Engineer, No. 603, April, p. 153; No. 604, May, p. 197.
The work of the Engineer's department. — II. (4 000 words & fig.)

1930 625 .233
The Railway Engineer, No. 603, April, p. 157; No. 604, May, p. 204.
COPPOCK (C.). — **Electric train-lighting equipment.** — VII-VIII. (2 300 words & fig.)

1930 625 .616 (.54)
The Railway Engineer, No. 603, April, p. 161.
New **narrow-gauge locomotives** for India. (1 800 words & fig.)

1930 625 .616 (.83)
The Railway Engineer, No. 603, April, p. 163.
New 2-6-2 **Diesel locomotive** for Chile. (1 200 words & fig.)

1930 656 .255
The Railway Engineer, No. 604, May, p. 174.
Passing trains at unattended places on single lines. (2 000 words & fig.)

1930 621 .132.3 (.42)
The Railway Engineer, No. 604, May, p. 177.
New express locomotives, Southern Railway. (600 words & fig.)

1930 621 .338 (.42) & 625 .212 (.42)
The Railway Engineer, No. 604, May, p. 177.
New electric trains with **roller bearings,** Metropolitan Railway. (200 words & fig.)

1930 656 .212 (.42) & 725 .31 (.42)
The Railway Engineer, No. 604, May, p. 181.
Reconstruction of Wimbledon station, Southern Railway. (2 200 words & fig.)

1930 625 .216
The Railway Engineer, No. 604, May, p. 191.
Materials used for **locomotive draw gear.** (1 100 words & table.)

1930 621 .132.8 (.62)
The Railway Engineer, No. 604, May, p. 193.
New **articulated steam rail car,** Egyptian State Railways. (2 200 words & fig.)

1930 621 .335 (.485) & 621 .43 (.485)
The Railway Engineer, No. 604, May, p. 200.
New **Diesel-electric locomotive design.** (800 words & fig.)

1930 621 .95 (.42)
The Railway Engineer, No. 604, May, p. 202.
A new **radial drilling machine.** (1 000 words & fig.)

1930 621 .138.5 (.42)
The Railway Engineer, No. 605, June, p. 217.
Boiler shop developments at Swindon Works, Great Western Railway. (1 700 words & fig.)

1930 621 .132.3 (.54)
The Railway Engineer, No. 605, June, p. 221.
Experimental four-cylinder express locomotives, Indian State Railways. (2 800 words & fig.)

1930 656 .255 (.42)
The Railway Engineer, No. 605, June, p. 227.
Signalling and single-line token working, Firbeck junction, South Yorkshire Joint Railway. (2 200 words & fig.)

1930 621 .134.1 (.42)
The Railway Engineer, No. 605, June, p. 230.
McARD (G. W.). — **Plotting points for valve ellipses.** (500 words & fig.)

1930 621 .335 & 621 .43
The Railway Engineer, No. 605, June, pp. 233 & 248.
The Diesel-electric system in rail service. (2 100 words & fig.)

1930 621 .132.6 (.42)
The Railway Engineer, No. 605, June, p. 238.
New 2-6-2 **passenger tank locomotives,** London Midland & Scottish Railway. (600 words & fig.)

1930 385 .4 (.42) & 625 .1 (.42)
The Railway Engineer, No. 605, June, p. 239.
The work of the Engineer's department. — III. (2 200 words & fig.)

30 625 .233
Railway Engineer, No. 605, June, p. 243.
PPOCK (C.). — **Electric train lighting equipment.**
X. (1 900 words & fig.)

30 625 .212
Railway Engineer, No. 605, June, p. 247.
MS (J. G. B.). — **Wheels for freight rolling-stock.**
0 words.)

30 625 .143.2
Railway Engineer, No. 606, July, p. 254.
gher **manganese rail steel.** (1 100 words.)

30 621 .132.8
Railway Engineer, No. 606, July, p. 258.
ARLING (C. S.). — **Reciprocating-turbine locomo-**
. (1 600 words & tables.)

30 656 .211 (.42) & 725 .31 (.42)
Railway Engineer, No. 606, July, p. 260.
construction of Epsom station, Southern Railway.
0 words & fig.)

30 625 .143.4
Railway Engineer, No. 606, July, p. 266.
GLIS (R. A.). — Four or six bolt **fishplates?** (350
ls.)

30 625 .234 (.42)
Railway Engineer, No. 606, July, p. 267.
ectrical heating of water in sleeping cars. (400 words
g.)

30 621 .132.3 (.436)
Railway Engineer, No. 606, July, p. 271.
IDL (O.). — New three-cylinder **2-8-4 type express**
notive, Austrian Federal Railways. (1 900 words
g.)

30 625 .162 (.42) & 656 .254 (.42)
Railway Engineer, No. 606, July, p. 275.
onomics in public road level crossing operation.
0 words & fig.)

30 385 .4 (.42) & 625 .1 (.42)
Railway Engineer, No. 606, July, p. 281.
ie work of the Engineer's department. — IV. (1 800
ls.)

30 625 .1
Railway Engineer, No. 606, July, p. 283.
EARN (Sir Gordon). — **Fifty years of permanent-**
practice. (2 600 words.)

30 621 .133.1
Railway Engineer, No. 606, July, p. 286.
ASSETT (H. N.). — The choice of **locomotive coal.**
0 words.)

Railway Engineering and Maintenance. (Chicago.)

1930 625 .175
Railway Engineering and Maintenance, April, p. 158.
KNOWLES (C. R.). — **The motor car power plant.**
(2 900 words & fig.)

1930 691 (.73)
Railway Engineering and Maintenance, April, p. 164.
Introducing mass production methods in building **concrete slabs.** (2 400 words & fig.)

1930 625 .172 (.73)
Railway Engineering and Maintenance, April, p. 169.
Curing soft spots in track by new method. (1 900 words & fig.)

1930 725 .3 (.73)
Railway Engineering and Maintenance, April, p. 171.
Tool houses of concrete blocks. (1 100 words & fig.)

1930 625 .142.2
Railway Engineering and Maintenance, April, p. 173.
Handling ties with safety. (1 500 words & figure.)

1930 725 .33 (.73)
Railway Engineering and Maintenance, April, p. 175.
GRIME (E. M.). — **Clean well screen.** (1 100 words & figure.)

1930 621 .133.7 (.73) & 725 .33 (.73)
Railway Engineering and Maintenance, May, p. 200.
COUGHLAN (R. E.). — **Treat** two and one-half million gallons water per day. (900 words & fig.)

1930 625 .175
Railway Engineering and Maintenance, May, p. 214.
KNOWLES (C. R.). — **How a truck motor** car is built. (3 400 words & fig.)

1930 625 .144.4 (.73)
Railway Engineering and Maintenance, June, p. 244.
Oiling the roadbed lays dust on the Long Island. (1 800 words & fig.)

1930 625 .175
Railway Engineering and Maintenance, June, p. 248.
KNOWLES (C. R.). — **Proper lubrication — the life of a motor car.** (3 100 words & fig.)

1930 625 .113
Railway Engineering and Maintenance, June, p. 257.
KISSAM (Phillip) and HOFFMAN (Carl T.). — **Rivising grade lines by string-line methods.** (1 500 words, tables & fig.)

1930 625 .142.2 (.73)
Railway Engineering and Maintenance, June, p. 261.
Getting more service out of **crossties.** (2 600 words.)

1930 621 .392 (.73) & 625 .143.4 (.73)
Railway Engineering and Maintenance, July, p. 286.
How the Canadian Pacific **arc-welds battered rail ends.** (1 900 words & fig.)

1930 625 .142.2 (.73) & 691 (.73)
Railway Engineering and Maintenance, July, p. 290.
And now **the termite problem.** Native forest insect is transferring its attention to railway and other structures and is causing widespread damage. (3 400 words & fig.)

1930 625 .175
Railway Engineering and Maintenance, July, p. 295.
KNOWLES (C. R.). — Getting a spark. How to keep the **ignition system** in condition to insure efficient **motor-car operation.** (2 900 words & fig.)

1930 614 .8 (.73)
Railway Engineering and Maintenance, July, p. 299.
KELLER (L. E.). — How to **reduce accidents.** (2 200 words, figure & table.)

1930 625 .17
Railway Engineering and Maintenance, July, p. 302.
EARL STIMSON. — Better materials **produce marked savings** but the field for further economies is a large one. (2 000 words.)

1930 313 : 656 .286
Railway Engineering and Maintenance, July, p. 305.
Reducing the **hazard at highway grade crossings.** (1 800 words & table.)

Railway Gazette. (London.)

1930 621 .132.8 (.42) & 621 .87 (.42)
Railway Gazette, 6 June, p. 875.
« **Sentinel** » **crane locomotive.** (300 words & fig.)

1930 625 .236 (.42)
Railway Gazette, 6 June, p. 877.
Carriage-washing plants on the London & North Eastern Railway. (650 words & fig.)

1930 656 .1 (.42)
Railway Gazette, 6 June, p. 880.
London Midland & Scottish Railway **road motor services.** (1 900 words & fig.)

1930 656 .1 (.71)
Railway Gazette, 6 June, p. 884.
Motor bus and motor truck transport in Canada. (1 400 words.)

1930 656
Railway Gazette, 6 June, p. 886.
An American view of **co-ordinated transportation.** (1 200 words.)

1930 625 .232 (.54)
Railway Gazette, 13 June, p. 911.
New **rolling-stock** for the Bombay, Baroda & Central India Railway. (750 words & fig.)

1930 656 .225 (.42) & 656 .261 (.
Railway Gazette, 13 June, p. 914.
New type of **containers,** Great Western Railw
(200 words & figure.)

1930 385 .4 (.
Railway Gazette, 13 June, p. 915.
British **Railway organisation since grouping.** (4
words.)

1930 625 .232 (.
Railway Gazette, 20 June, p. 944.
New **rolling-stock** for the Entre Rios Railways.
words & fig.)

1930 656 .257 (.9
Railway Gazette, 20 June, p. 949.
Power interlockings on the New South Wales Gov
ment Railways. (800 words & fig.)

1930 625 .231 (.
Railway Gazette, 20 June, p. 954.
New Southern Railway **bogie passenger luggage v**
(300 words & figure.)

1930 656 .211 (.42) & 725 .31 (.
Railway Gazette, 27 June, p. 976.
Reconstruction of Great Western Railway sta
at Newport, Mon. (500 words & fig.)

1930 621 .94 (.
Railway Gazette, 27 June, p. 979.
A new heavy vertical **tyre mill.** (600 words &

1930 625 .172 (.
Railway Gazette, 27 June, p. 980.
Motor trolleys for permanent-way maintenance s
London & North Eastern Railway. (600 words &

1930 621
Railway Gazette, 27 June, p. 981.
Economical operation of electrified railways. (1
words.)

1930 656 .225 (.
Railway Gazette, 27 June, p. 983.
Transit of **perishable commodities** in France.
words.)

1930 625 .232 (
Railway Gazette, 27 June, p. 987.
New **postal vans** for the Central Argentine Rail
(500 words & fig.)

1930 625 .232 (
Railway Gazette, 4 July, p. 9.
New **first-class corridor coaches,** London & N
Eastern Railway. (1 100 words & fig.)

1930 656 .1 (
Railway Gazette, 4 July, p. 22.
The rail and road situation in Germany. (950 w
& tables.)

1930 347 .763 (.68)
Railway Gazette, 4 July, p. 24.
The South African motor carrier transportation act. (900 words.)

1930 625 .13 (.42 + .44)
Railway Gazette, 4 July, p. 36.
Channel tunnel scheme rejected by Commons. (1 900 words.)

1930 656 .222 (.42) & 625 .232 (.42)
Railway Gazette, 11 July, p. 52.
New **trains** for the « Royal Scot », London Midland & Scottish Railway. (1 100 words & fig.)

1930 385 .4 (.42) & 625 .26 (.42)
Railway Gazette, 11 July, p. 58.
Railway amalgamation and its effect on the workshops. (5 000 words.)

1930 621 .33 (.42)
Railway Gazette, 25 July, p. 121.
SMITH (Roger T.). — The **present position of electric traction** in Great Britain. (2 100 words, table & map.)

1930 621 .33 (.485)
Railway Gazette, 25 July, p. 124.
The Stockholm-Gothenburg **electrification.** (1 000 words.)

1930 621 .335 (.44)
Railway Gazette, 25 July, p. 129.
New high-powered **electric locomotives** of the P. L. M. Railway. (800 words, tables & figure.)

Railway Magazine. (London.)

1930 656 .222.1 (.42)
Railway Magazine, March, p. 189; April, p. 275; May, p. 361; June, p. 451; July, p. 13 and August, p. 128.
ALLEN (Cecil J.). — British **locomotive performance** and practice. (32 000 words, tables & fig.)

1930 621 .33
Railway Magazine, April, p. 290 and May, p. 376.
RICH (T.). — **Railway electrification** in Italy (4 200 words, 1 map & fig.)

Railway Mechanical Engineer. (New York.)

1930 621 .138 (.73)
Railway Mechanical Engineer, June, p. 301.
Modern facilities — their effect on **engine terminal operation.** (3 500 words, tables & fig.)

1930 625 .26 (.73)
Railway Mechanical Engineer, June, p. 307.
ALLEN (H. K.). — Modernizing a **car repair shop.** (3 900 words & fig.)

1930 621 .9
Railway Mechanical Engineer, June, p. 312.
The turrel lathe — a general purpose tool. A machine shop foreman tells how locomotive parts can be made on a turret lathe. (2 500 words & fig.)

1930 621 .135.2 (.73)
Railway Mechanical Engineer, June, p. 316.
Timken **roller-bearing locomotive.** (3 200 words & fig.)

1930 621 .133.1 (06 (08 (.73)
Railway Mechanical Engineer, June, p. 325; July, p. 404.
Fuel Association work commended by Railroad Officers. (4 400 words, tables & fig.)

1930 625 .25 (06 (08 (.73)
Railway Mechanical Engineer, June, p. 331; July, p. 403.
Thirty-seventh Air Brake Convention. (4 000 words & fig.)

1930 621 .133.3 (06 (08 (.73)
Railway Mechanical Engineer, June, p. 335.
Boiler Makers meet at Pittsburgh. (1 900 words & fig.)

1930 621 .132.5 (.73)
Railway Mechanical Engineer, July, p. 387.
Delaware & Hudson procures third **high-pressure locomotive** equipped with water-tube firebox similar to « John B. Jersis », working boiler pressure of 500 lb. (1 700 words, tables & fig.)

1930 625 .246 (.73)
Railway Mechanical Engineer, July, p. 393.
BARTHELEMY (P. P.). — **Corrosion of steel freight cars.** (3 000 words & fig.)

1930 625 .245 (.73)
Railway Mechanical Engineer, July, p. 397.
New Milwaukee **dynamometer car.** (2 400 words & fig.)

1930 621 .131.1
Railway Mechanical Engineer, July, p. 400.
BOTTERON (L. K.). — **Locomotive back pressure.** Analysis of the laws governing steam flow through the exhaust nozzle and their relation to back pressure. (1 700 words, tables & fig.)

Railway Signaling. (Chicago.)

1930 656 .256.3 (.71)
Railway Signaling, No. 4, April, p. 125.
DAIRES (A.). — Canadian Pacific installs **automatics** through mountains. (1 600 words & fig.)

1930 656 .255 (.71)
Railway Signaling, No. 4, April, p. 128.
TAYLOR (C. A.). — Cheasapeake & Ohio installs **new interlocking** and **either direction signaling.** (4 200 words & fig.)

1930 656 .255 (.73)
Railway Signaling, No. 4, April, p. 135.
ZANE (W. F.). — **Centralized control** on nine miles of double track. (1 000 words & fig.)

1930 656 .255 (.73)
Railway Signaling, No. 4, April, p. 138.
Texas & Pacific uses **remote control** on 51 miles of double track. (850 words & fig.)

1930 656 .255 (.73)
Railway Signaling, No. 4, April, p. 141.
PORTER (L. B.). — **Color-light automatic block signals and automatic interlocking** installed on the Janesville Line of the Milwaukee. (1 400 words & fig.)

1930 656 .256.3 (.73)
Railway Signaling, No. 5, May, p. 161.
The Missouri-Kansas-Texas installs **color light signals.** (1 000 words & fig.)

1930 656 .257 (.73)
Railway Signaling, No. 5, May, p. 163.
FULLER (D. W.). — Train movements entering and leaving large yard expedited by an **electric interlocking.** (1 400 words & fig.)

1930 656 .253 (.73)
Railway Signaling, No. 5, May, p. 166.
BENDER (F. W.). — Central New Jersey installs **cab signaling on single track** without permissive wayside signals. (3 000 words & fig.)

1930 056 .255 (.73)
Railway Signaling, No. 5, May, p. 172.
CORFIELD (R. J.). — **Centralized control** on the Bingham & Garfield. (1 000 words & fig.)

1930 656 .253 (.73)
Railway Signaling, No. 5, May, p. 175.
Wabash tests **automatic train control with cab-lights.** (2 700 words & fig.)

1930 656 .256.3 (.73)
Railway Signaling, No. 5, May, p. 181.
Absolute permissive block signals on the International Great Northern reduce delays and increase safety of train operation. (1 000 words & fig.)

1930 625 .258 (.73) & 656 .254 (.73)
Railway Signaling, No. 6, June, p. 201.
Car retarders installed by Chicago & North Western at Proviso Yard, near Chicago. (2 500 words & fig.)

1930 656 .257 (.73)
Railway Signaling, No. 6, June, p. 206.
Interlocking at St. Louis Union station expanded 30 per cent. (1 700 words & fig.)

1930 656 .257 (.73)
Railway Signaling, No. 6, June, p. 209.
WESSON (E. G.). — New **electric interlocking** on the Burlington eliminates 160 train stops per day. (1 700 words & fig.)

1930 656 .256.3 (.73
Railway Signaling, No. 6, June, p. 213.
MORGAN (H. G.). — Illinois Central installs colo**light signals on 80 miles of single track.** New type rail connections is feature. (1 200 words & fig.)

1930 625 .162 (.73) & 656 .254 (.73
Railway Signaling, No. 6, June, p. 215.
The Missouri-Kansas-Texas installs unique **highwa crossing protection** at eleven streets in Clinton, M (650 words & fig.)

1930 625 .162 (.73
Railway Signaling, No. 6, June, p. 216.
Joint Committee report on crossing protection. (45 words.)

1930 691 (.73
Railway Signaling, No. 6, June, p. 217.
MEYERS (R. E.). — **Developments in the creosote pine pole industry.** (1 100 words, tables & fig.)

1930 656 .255 (.73
Railway Signaling, No. 7, July, p. 237.
Centralized traffic control on 40 miles of the Souther Pacific. (3 400 words & fig.)

1930 656 .257 (.73
Railway Signaling, No. 7, July, p. 243.
BECK (G. E.). — New York Central's reconstructio program at South Bend involves new **electric interlockin** with design which minimizes maintenance costs. (1 70 words & fig.)

1930 625 .258 (.73) & 656 .254 (.73
Railway Signaling, No. 7, July, p. 250.
The Pennsylvania installs **car retarders** in Pitcair yard near Pittsburgh, Pa. (1 000 words & fig.)

1930 656 .255 (.73
Railway Signaling, No. 7, July, p. 255.
Louisville & Nashville installs **automatic block signal** on 130 miles of single track. (2 000 words & fig.)

South African Railways & Harbours Magazine (Johannesburg.)

1930 656 .23 (.68
South African Railways and Harbours Mag., Apr., p. 54
The Union's railway tariff policy. (2 900 words.)

The Journal of the Institution of Engineers, Australia. (Sydney.)

1930 625 .13 (.944
Journal of the Inst. of Eng., Australia, February, p. 4
KEITH AIRD FRASER. — **Methods of tunnelling** used on the City of Sidney Underground Railway. (10 0 words & fig.)

1930 624 .2

Journal of the Inst. of Eng., Australia, March, p. 73.

EDWARD MILRAY SHEPHERD. — **Influence lines as deflection diagrams.** (5 700 words & fig.)

1930 621 .32 & 621 .39

Journal of the Inst. of Eng., Australia, April, p. 111.

BRUCE LINCOLNE (Gerald) and SNOWDEN DEMAINE (Charles). — **The electrical equipment of buildings.** (10 000 words & fig.)

1930 625 .13 (.945)

Journal of the Inst. of Eng., Australia, June, p. 189.

DINSEY CHAPMAN (Wilfrid). — **Railway viaducts** on the Albion to Broadmeadows line. (6 000 words & fig.)

University of Illinois Bulletin. (Urbana.)

1930 62. (01 & 691

University of Illinois Bulletin, No. 202, 25 Febr., p. 1.

WILSON (W. M.). — Laboratory **tests of reinforced concrete arch ribs.** (28 000 words, 33 tables & fig.)

1930 624 .63 & 721 .4

University of Illinois Bulletin, No. 203, 18 March, p. 1.

CROSS (Hardy). — Dependability of the **theory of concrete arches.** (4 000 words, 6 tables & fig.)

1930 621

University of Illinois Bulletin, No. 207, 27 May, p. 1.

POLSON (J. A.), LOWTHER (J. G.) and WILSON (B. J.). — The **flow of air through circular orifices** with rounded approach. (3 000 words, 17 tables & fig.)

In Spanish.

Ingenieria y Construcción. (Madrid.)

1930 691

Ingenieria y Construcción, julio, p. 345.

COSTA (Norberto P.). — Algunas observaciones relativas a la **constitución de cementos.** (6 000 palabras & fig.)

Revista de Obras Publicas. (Madrid.)

1930 385. (09 (.460)

Revista de Obras Publicas, n° 11, 1° de junio, p. 273; n° 12, 15 de junio, p. 293.

MACHIMBARRENA (V.). — **La mejora y ampliacion de la red ferroviaria española.** (5 400 palabras & fig.)

1930 385. (09 (.64)

Revista de Obras Publicas, n° 12, 15 de junio, p. 297; n° 13, 1° de julio, p. 317.

EUGENIO RIBERA (J.). — **El ferrocarril de Tánger à Fez.** (4 000 palabras & fig.)

1930 624. (01

Revista de Obras Publicas, n° 13, 1° de julio, p. 319; n° 14, 15 de julio, p. 337.

MENDIZÁBAL (D.). — **Influencias de las variaciones de temperatura en las deformaciones de los tramos metálicos.** (3 600 palabras & fig.)

In Italian.

L'Ingegnere. (Roma.)

1930 624 .9

L'Ingegnere, giugno, p. 393.

CARLO FELICE JODI. — **Il doppio portale simmetrico.** (1 500 parole & fig.)

Notiziario Tecnico. (Firenze.)

1930 621 .134.3 (.45)

Notiziario Tecnico, giugno, p. 201.

Verifiche sulla **distribuzione « Caprotti »** montata sulle locomotive F. S. (3 500 parole & fig.)

Rivista delle Comunicazioni ferroviarie. (Roma.)

1930 656 .1 (.45) & 656 .2 (.45)

Revista delle Comunicazioni ferrov., n° 11, 1° giug., p. 13.

Azione concreta per la **collaborazione fra automobili e ferrovie.** (1 100 parole.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1930 656 .234 (.4)

Rivista tecnica delle ferrovie ital., 15 giugno, p. 272.

BATTISTI (C.). — **Tariffe viaggiatori** delle Ferrovie Europee. (5 700 parole & tav.)

1930 625 .143.3

Rivista tecnica delle ferrovie ital., 15 giugno, p. 292.

ABBOLITO (Francesco). — **Sul comportamento in opera di rotaie di acciaio al rame.** (900 parole & fig.)

1930 656 .1 (.43) & 656 .2 (.43)

Rivista tecnica delle ferrovie ital., 15 giugno, p. 297.

SALVATORE MALTESE. — **La concorrenza tra ferrovie ed automobili in Germania.** (2 300 parole.)

In Dutch.

De Ingenieur. (Den Haag.)

1930 388

De Ingenieur, N^r 19, 9 Mei, bl. V. 21.

NIEUWENHUIS (J. G. J. C.). — **Verkeersproblemen** in groote steden. (6 000 woorden & fig.)

1930 624 .5 (.73)

De Ingenieur, N^r 23, 6 Juni, bl. B. 103.

KIST (N. C.). — **Brug** over de Hudson bij New-York met een **overspanning van 1 067 m.** (4 000 woorden & fig.)

1930 721

De Ingenieur, N^r 29, 18 Juli, bl. B. 159.

Het bouwtoezicht en de **groote ijzerconstructies.** (2 500 woorden & fig.)

Spoor- en Tramwegen. (Utrecht.)

1930 625 .23

Spoor- en Tramwegen, N^r 8, 15 April, bl. 213.

BOLLEMAN KIJLSTRA (E.). — **Ijzerne Rijtuigen** en in het bijzonder die der Nord Français. (1 400 woorden & fig.)

1930 656 .215 (.92)

Spoor- en Tramwegen, N^r 8, 15 April, bl. 218.

FRONEZEK (H. H.). — Het **Verlichten** van **Spoorweg Emplacementen** in Nederlandsch-Indië door middel van Floodlights (Vloedlichten). (1 600 woorden & fig.)

1930 385. (09 (.59)

Spoor- en Tramwegen, N^r 8, 15 April, bl. 226 en N^r 9, 29 April, bl. 254 en 255.

MIGNON (A.). — **De Spoorwegen in Indo-China.** (2 500 woorden & fig.)

1930 625 .251

Spoor- en Tramwegen, N^r 9, 29 April, bl. 244 en 246; N^r 10, 13 Mei, bl. 277 en 279; N^r 11, 27 Mei, bl. 315.

ROVERS (M. H.). — **Beremming van Goederentreinen.** (3 500 woorden & fig.)

1930 621 .335 (.436)

Spoor- en Tramwegen, N^r 9, 29 April, bl. 250.

De **electr. locomotieven** der Oostenrijksche Bondsspoorwegen. (950 woorden & fig.)

1930 621 .33 (.494)

Spoor- en Tramwegen, N^r 9, 29 April, bl. 257; N^r 10, 13 Mei, bl. 287 en 289.

De Electrificatie van de Zwitsersche Bondsspoorwegen. (2 500 woorden & fig.)

1930 385 .1

Spoor- en Tramwegen, N^r 13, 24 Juni, p. 373.

Spoorwegfinanciën en Crisismaatregelen. (2 100 woorden.)

1930 625 .5 (.433)

Spoor- en Tramwegen, N^r 13, 24 Juni, bl. 381 en 383.

ETTY LEAL. — **De Bergbanen van Beieren.** (900 woorden & fig.)

1930 656 .211.5

Spoor- en Tramwegen, N^r 1, 8 Juli, bl. 1.

CLARINGBOULD (H.). — **Aanwijzingen op de Stations.** (2 400 woorden & fig.)

1930 385 .113 (.492)

Spoor- en Tramwegen, N^r 1, 8 Juli, bl. 20.

De Nederlandsche Spoorwegen over 1929. (900 woorden & tabelen.)

1930 621 .33 (.485)

Spoor- en Tramwegen, N^r 2, 22 Juli, bl.

DE GELDER (Dr. G.). — De **Electrificatie** der Zweedsche Staatsspoorwegen. (800 woorden & fig.)

In Polish.

INŻYNIER KOLEJOWY (Warszawa).

1930 656 .1 & 656 .2

Inzynier Kolejowy, 1 Maja, str. 159; 1 Czerwca, str. 203.

WASIUTYNSKI (Dr. Al.). — **Konkurencja ruchu samochodowego.** (11 000 slowa.)

1930 625 .14 (.438)

Inzynier Kolejowy, 1 Czerwca, str. 195.

WIKTOR (St.). — Samodzielne próby graficznego ujecia kosztów utrzymania nawierzchni na kolejach polskich. (5 100 slowa & rys.)

1930 625 .6 (.438)

Inzynier Kolejowy, 1 Lipca, str. 240.

Koleje waskotorowe Polskich Kolei Pánstwowych (3 400 slowa & rys.)

1930 385. (09 (.438)

Inzynier Kolejowy, 1 Sierpnia, str. 305.

SZTOLCMAN (S.). — **Udziat polskich kolei w przewozach miedzynarodowych.** (2 800 slowa & rys.)

In Portuguese.

Revista das Estradas de Ferro. (Rio de Janeiro.)

1930 625 .1 (.81)

Revista das Estradas de Ferro, n° 119, 30 de Junho p. 273.

A Estrada de Ferro do Paraná. (4 500 palavras & fig.

9487. — Publisher : M. Weissenbruch Co., Ltd., Printer to the King, 49, rue du Poinçon, Brussels.

MONTHLY BIBLIOGRAPHY OF RAILWAYS [1].

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General secretary of the Permanent Commission of the International Railway Congress Association.

(NOVEMBER 1930)

[016 .385 (02]

I. — BOOKS

In French.

1930 313 .385 (.495)

Chemins de fer de l'Etat Hellénique. Statistique des xercices 1927-1928.

Un volume broché (21 × 27 cm.).

Athènes, Chemins de fer de l'Etat Hellénique.

1930 744

HEMINS DE FER FRANÇAIS. GRANDS RESEAUX.

Instructions pour l'exécution des dessins techniques.

Paris (6e), Librairie polytechnique Ch. Béranger, , rue des Saints-Pères; Liége, 1, quai de la Grande- retagne. Un volume 1-8 colombier (15 × 22 cm.) de pages, avec 37 fig. dans le texte. (Prix : relié, francs.)

1930 621

ECORNU (L.), inspecteur général des mines.

Propriétés générales des machines.

Paris, Librairie J.-B. Baillière et fils, éditeurs, rue utefeuille, 19. Un volume grand in-8°, de 232 pages, ec 91 figures. (Prix : 40 francs.)

1930 691

Travail du béton.

Paris (6e), Librairie polytechnique Ch. Béranger, rue des Saints-Pères; Liége, 1, quai de la Grande- etagne. Un volume in-8° carré (14 × 22 cm.) de pages, avec 167 figures dans le texte. (Prix : francs.)

1930 625. (02

Les travaux.

Saint-Just-en-Chaussée (Oise), G. Sterlin, 7, rue miens. Un volume (13 × 21 cm.), 212 pages. (Prix : francs.)

1930 669

UDIE (P.).

Le contrôle de la dureté des métaux dans l'industrie. Paris (6e), Dunod, 92, rue Bonaparte. Un volume relié × 25 cm.), 114 pages. (Prix : 35 francs.)

In German.

1930 621 .8

BETHMANN (H.).

Die Hebezeuge. Berechnung und Konstruktion der Einzelteile, Flaschenzüge, Winden und Krane. 8. vollständig neubearbeitete Auflage mit 1 275 Abbildungen im Text und auf 10 Tafeln und 110 Tabellen.

Braunschweig 1930. Verlag Friedrich Vieweg & Sohn A.-G. (Preis geh. : 20 Rm.)

1929 621 .133.7

DEUTSCH (H.).

Der Abdampfinjektor im Vergleich mit dem Oberflächenvorwärmer.

Wien, Alex. Friedmann.

1930 624 .32 (.43) & 624 .62 (.43)

DEUTSCHE REICHSBAHN GESELLSCHAFT.

Hilfswerte für das Berechnen und Entwerfen stählerner Eisenbahnbrücken.

Berlin, W. 8. Verlag von W. Ernst und Sohn. 130 Seiten mit 117 Tafeln. (Preis : 15 Rm.)

1929 651

FEINDLER (R.).

Das Hollerith-Lochkarten Verfahren für maschinelle Buchhaltung und Statistik.

Mit 172 Abbildungen im Text und 425 Seiten in gr.-8°. Verlag Reimar Hobbing, Berlin 1929. (Preis geh. : 26 Rm.; geb. 30 Rm.)

1929 625 .113

G. H. A. Kröhnkes Taschenbuch zum Abstecken von Bögen bei Bahnen, Kanälen und Wegen.

Siebzehnte Auflage. Bearbeitet von R. Seifert, Direktor und Professor in Berlin. Mit 21 Abbildungen. Leipzig und Berlin 1929. Verlag und Druck von B. G. Teubner. (Preis : 4.60 Rm.)

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[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly the Office Bibliographique International. of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by Weissenbruch in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1930 721 .9

Handbuch für Eisenbetonbau.

Vierte, vollkommen neubearbeitete Auflage. Herausgegeben von Dr. **F. Emperger.** Erster Band : Geschichtliche Entwicklung, Versuche, Theorie. Bearbeitet von Dr. **M. Foerster,** Prof. **O. Graf** und Prof. **O. Domke.** xxiv und 585 Seiten, 781 Abbildungen.

Verlag von Wilhelm Ernst & Sohn, Berlin. (Preis geheftet : 44 Rm.; gebunden : 47 Rm.)

1930 385 .517 (.43)

HEIGES (K.).

Die **Sozialversicherungs- und Wohlfahrtseinrichtungen** bei der Deutschen Reichsbahn.

Verlag der Verkehrswissenschaftlichen Lehrmittel-Gesellschaft m. b. H. bei der Deutschen Reichsbahn. Heft 6, **Heiges :** Die **Wohlfahrts-** und **Selbsthilfe-Einrichtungen.** 126 Seiten. Heft 7, **Kuhatscheck :** Die **Angestellten-** und **Arbeitslosen-Versicherung.** 87 Seiten.

1930 0

HERMANN (Hubert).

Techno-Diktionär : English, German and Italian. Published by the author. Berlin-Lichterfelde (West). Dahlemer Strasse 64 A. 1 vol. (6 × 4 1/2 inches) of 411 pages. (Price : 15 sh.)

1930 385 .586 (.43)

HONOLD (R.).

Wege der Personalaus- und Fortbildung bei der Deutschen Reichsbahn unter Berücksichtigung der Einrichtungen bei anderen Grossbetrieben.

Berlin, Verlag der Verkehrswissenschaftlichen Lehrmittelgesellschaft m. b. H. bei der Deutschen Reichsbahn. (Preis geh. : 2.75 Rm.)

1930 625 .1

KOCHENRATH (W.).

Grundzüge des Eisenbahnbaues. I. Teil, Linienführung, Unter- und Oberbau, Schutz- und Nebenanlagen auf freier Strecke, 3. neubearbeitete Auflage, Verlagsbuchhandlung Dr. Max Jänecke, Leipzig. (Preis : 5.70 Rm.)

1930 621 & 621 .392

KOMMERELL (O.).

Berechnung, bauliche Durchbildung und Ausführung geschweisster Eisenbahnbrücken.

Leipzig, Johann Ambrosius Barth-Verlag. 19 Seiten mit 25 Textabbildungen. 4°. (Preis : 1.30 Rm.)

1930 621 .335

LINDNER (H. G.).

Gewichtsverlegung und Ausnutzung des Reibungsgewichtes bei elektrischen Lokomotiven mit Einzelachsantrieb.

Leipzig, Johann Ambrosius Barth.-Verlag. iv, 25 Seiten mit 32 Abbildungen, 2 Zahlentafeln und 2 Tabellen. 4°. (Preis : 5 Rm.; V. D. I.-Mitgl. : 4.50 Rm.)

1930 721 .9 & 624

MÖRSCH (E.).

Der **Eisenbetonbau,** seine Theorie und Anwendung.

Leipzig, Johann Ambrosius Barth-Verlag. 5. vollst dig neu bearbeitete und vermehrte Auflage. Bd. 2, Th Brücken. Lfg. 1. III, 160 Seiten mit 218 Textabbildung 4°. (Preis : 9 Rm.)

1930 385. (09.3 (.43) & 623 (.

SARTER (Dr. A.).

Die **deutschen** Eisenbahnen im Kriege.

Deutsche Verlagsanstalt Stuttgart, Berlin und Leip Wirtschafts- und Sozialgeschichte des Weltkrieg Deutsche Serie. Herausgegeben durch die Carnegie-S tung für Internationalen Frieden. (Preis : 14 Rm.)

1930 385. (09.3 (.

STIEHLER (Dr. C.).

Vor 10 Jahren, **Erinnerungen** an die Verreichlich der Deutschen Staatsbahnen und kritische Betracht gen. Berlin 1930. Verkehrswissenschaftliche Lehrmitt gesellschaft m. b. H. bei der Deutschen Reichsba 118 Seiten Oktav.

1930 625

ZIMMERMANN (H.).

Die **Berechnung** des Eisenbahnoberbaues.

Leipzig, Johann Ambrosius Barth.-Verlag. 2. beri tigte Auflage. xiv, 308 Seiten mit 118 Textabbildung 12 Tafeln und zahlreichen Tabellen. gr. 8°. (Prei 36 Rm.; Lw. : 38 Rm.)

In English.

1930 656 .253. (02 (.

AMERICAN RAILWAY ASSOCIATION, SIGN SECTION.

American railway signaling. — Principles and pr tices. Chapter XII. **Semaphore signals.**

New York, Signal Section, A. R. A., 30 Vesey Stre 1 pamphlet (6 × 9 inches) of 84 pages, with tables fig. (Price. — For members and railroad employee 25 cents. For non-railroad employees : 35 cents.)

1930 656 .253. (02 (.

AMERICAN RAILWAY ASSOCIATION, SIGN SECTION.

American railway signaling. — Principles and pr tices. Chapter XIII. **Light signals.**

New York. Signal Section. A. R. A., 30 Vesey Stre 1 pamphlet (6 × 9 inches) of 48 pages with table fig. (Price. — For members and railroad employee 25 cents. For non-railroad employees : 35 cents.)

1930 62. (01 (06 (.73) & 691. (06 (.

AMERICAN SOCIETY FOR TESTING MATERIA

Proceedings of the 32nd Annual Meeting. Vol. Part I. Committee reports. New and **revised standar** Part II. Technical papers.

Philadelphia : Headquarters of the Society, 13 Spruce Street. (Price : Part I, $ 6.00. Part II, $ 6.0

1930 51 (08

ORDMAN (Harry Clow.), Chicago Bridge and Iron Works.

Table for use in computing arcs, chords and versines.

Chicago : The author, 1305 West 105th Street. 1 pamphlet (5 × 7 inches) of 32 pages. (Price : $ 1.00.)

1930 621. (02

OYD (J. E.), M. S., Professor of mechanics, Ohio State University.

Mechanics. A text book for engineers. Second edition.

ew York and London : McGraw Hill Book Co. 1 vol. × 9 inches) of 384 pages; 312 line cuts. (Price, cloth: 3.50.)

1930 691

RADY (F. L.).

The corrosion of steel by breeze and clinker concretes.

London : H. M. Stationery Office. One pamphlet × 9 1/2 inches) of 15 pages, halftones, line cuts and bles.

1930 621

UTTERFIELD (Thomas E.).

Steam and gas engineering.

London : Macmillan & Co., Ltd. (Price : 18 sh. net.)

1930 621 .32

ALDWELL (Frank C.).

Modern lighting.

New York, Macmillan Company. — 1 vol. (6 × 9 ches) of 386 pages with illustrations and diagrams. rice : $ 4.25.)

1930 385. (09 (.42)

ENDY MARSHALL (C. F.).

One hundred years of railways.

Published by London Midland & Scottish Railway. rice : 1 sh.)

1929 385. (08 (.52)

EPARTMENT OF RAILWAYS, GOVERNMENT OF JAPAN.

Annual report for the year ending March 31st 1929. vol. (7 1/2 × 10 1/4 inches) of 246 pages. Folded ate and map, 11 diagrams, tables and figures.

1930 657 (.54)

OPALAN (L. V.).

Solutions to questions, Part II, **Examinations of the overnment of India Railway Subordinate Accounts rvice.**

Published by The Imperial Printing Works, 23 David- n Street, Madras, India. 1 volume (5 × 8 1/4 inches) und in cloth.

1930 62. (01 & 624 .2

LEMING (Robins), Structural Engineer, American Bridge Co.

Wind stresses in buildings, with a chapter on earth- akes and earthquake resistance.

New York and London : John Wiley & Sons, Inc. ol. (6 × 9 inches) of 193 pages with halftones, line s and tables. (Price, cloth : $ 3.50.)

1930 313 .225 (.73)

Freight commodity statistics, Class I steam railways in the United States, Year ended 31 december 1929.

Washington D. C. Published by U. S. Government Printing Office. 1 pamphlet, 133 pages. (Price : 80 cents.)

1930 625 .123. (02

Handbook of culvert and drainage practice. Published by the Armco Culvert Manufacturers Association, Middletown, Ohio.

One vol., 349 pages (4 1/2 × 7 inches) illustrated. Bound in flexible imitation leather cover. (Price : $ 2.)

1930 656 .222. (09 (.73)

HUNGERFORD (Edward).

The run of the Twentieth Century.

Published by the Publication Bureau, New York Central Lines, Room 1518, 466 Lexington Avenue, New York, at the Du-Bois Press, Rochester, N. Y. One vol. (6 × 9 inches). 110 pages illustrated. Bound in paper. (Price : 50 cents.)

1930 669 .1

IMHOFF (W. G.).

Pickling of iron and steel.

Cleveland, Ohio and London : The Penton Publishing Company, Ltd. (Price : 25 sh. net.)

1930 669

JUDGE (Arthur W.).

Engineering materials.

London : Sir Isaac Pitman and Sons, Limited. Vol. I, **Ferrous.** (Price : 30 sh. net.)

1930 38 (06

LEAGUE OF NATIONS.

Advisory and Technical Committee for Communications and Transit. Minutes of the 14th Session, Geneva, 10-15 March 1930.

Series of League of Nations Publications : VIII. Transit 1930. VIII. 4. 1 volume, 8 1/4 × 13 inches, 148 pages.

1930 621 .13 (02 (.73)

Locomotive Cyclopedia of American practice. Ninth edition. Compiled and edited for the American Railway Association. Mechanical Division, by Roy V. Wright and others.

New York. The Simmons Boardman Publishing Co. 1 vol. (9 × 12 inches) of 1 440 pages, illustrations and diagrams. (Price, clothbound : $ 5.00.)

1930 621. (02

MARKS' Mechanical Engineers' Handbook.

Editor-in-Chief, Lionel S. Marks, professor of mechanical engineering, Harvard University.

Published by the McGraw-Hill Book Company, Inc., 370 Seventh avenue, New York. Un vol. (4 1/2 × 7 inches) of 2 264 pages. Bound in leather. (Price : $ 7.)

1930 313. (02

MUDGETT (Bruce D.).

Statistical tables and graphs.

Boston (U. S. A.), Houghton Miffin Co. One volume (5 × 8 inches) of 194 pages, illustrated. (Price, cloth : $ 1.75.)

1930 385 .1 (.73)

MUNDY (Floyd W.).

Earning Power of Railroads. Twenty-fifth issue. New York, Jas. H. Oliphant & Co. One vol., 703 pages, 20 maps. **Apply.**

1930 69 & 72

Modern steelwork. A review of current practice in the employment of structural steel in buildings and bridges. Edited by W. R. Gilbert.

London : The British Steelwork Association. (Price : 5 sh.)

1930 657 (.42)

NEWTON (C. H.), Chief accountant, London & North Eastern Railway.

Railway Accounts.

London : Sir Isaac Pitman & Sons Ltd., Parker Street, Kingsway, W. C. 2. 1 vol. (8 3/4 × 6 × 1 inches) of 245 pages. (Price, cloth : 10 sh. 6 d.)

1930 385. (08 (.66)

NIGERIAN RAILWAY AND UDI COAL MINES.

Administrative Report for the year ended 31st March 1930 (with appendices).

Ebute Metta : Superintendent of Press, Nigerian Railway. 1 vol. (8 × 13 inches) of 85 pages with numerous illustrations and tables.

1930 656 .213. (02 (.42)

OLDHAM (William).

A guide to private siding problems, railway rates and charges, etc.

London : Industrial Transport Publications Limited, Dudley House, Southampton Street, Strand, W. C. 2. 1 vol. (8 3/4 × 5 3/4 inches) of 90 pages. (Price : 5 sh. net.)

1930 385. (09.1 (.73)

Railroad map of the United States.

Published by the U. S. Government Printing Office, Washington, D. C. Prepared under the direction of Chief of Engineers, U. S. Army. Issue of July, 1930. 4 sheets, making a wall map about 7 × 4 feet when mounted.

1930 385 .56

ROBERTS (E. R. B.).

British Railways and Unemployment.

London : Industrial Transport Publications Ltd., Dudley House, Southampton Street, W. C. 2. (Price : 1 sh. net.)

1930 385. (01

SPENGLER (Edwin H.).

Land values in New York in relation to transit facilities.

Columbia University. Studies in political science, No. 333. New York : Columbia University Press. London : P. S. King & Son Ltd., Orchard House, Westminster. S. W. 1. 1 vol., (9 × 6 inches) of 179 pages. (Price : 12 sh.)

1930 62. (01 & 624

SPURR (Henry V.).

Wind bracing : The importance of rigidity in hi towers.

New York and London : McGraw-Hill Book C Inc. 1 vol. (6 × 9 inches) of 132 pages; line cu (Price, cloth : $ 3.00.)

1930 313 .656.25 (.7

Tabulation of **statistics pertaining to signals, aut matic train control, and telegraph and telephone f** transmission of train orders as used on the Railroa of the United States. 1 January 1930.

Washington, D. C. Published by the United Stat Government Printing Office, 1 pamphlet of 19 page (Price : 10 cents.)

1930 385. (071 (.42

THE LONDON SCHOOL OF ECONOMICS and Politic Science (University of London), Houghton Stree Aldwych, W. C. 2.

Summary Programme, Session 1930-1931.

1 pamphlet (5 × 8 inches) of 68 pages. (Price 6 d.)

1930 62. (0

TIMOSHENKO (S.), Professor of engineering mecha nics, University of Michigan.

Strength of materials.

New York : D. Van Nostrand Co., Inc. — Part I **Elementary theory and problems.** 1 vol. (6 × 9 inches of 368 pages, illustrated. (Price, cloth $ 3.50). Part II **Advanced theory and problems.** 1 vol. (6 × 9 inches of 735 pages, illustrated. (Price, cloth : $ 4.50.)

1930 385. (09.1 (.58

TURKSIB, 1928-1930.

Published by The Soviet Union Society for cultura relations with foreign countries (VOKS), Moscow A series of illustrated papers on the construction o the opening of, and the prospects of the Turkesta Siberian Railway, opened May 1, 1930. Includes map 64 pages. **Apply.**

1930 621 .133.

Water softening : The base exchange or zeolite pr cess. Summary of existing knowledge.

Department of scientific and industrial researc Water pollution research. Technical paper No. 1. H. M Stationery Office. (Price : 6 d. net.)

In Spanish.

1930 625 .4 (.460

El Ferrocarril **Metropolitano** Alfonso XIII de Madri

Publicaciones de la Compañia. — 71 páginas, num rosas fotografias, planos, figuras y cuadros.

Madrid, Avenida de Pi y Margall, 7.

1930 385. (09.3 (.460)

ANUEL MARIA ARRILLAGA.

Los iniciadores y promotores de los Caminos de Hierro e España (1830-1855).

Obsequio de la Compañia de Madrid a Zaragoza y a licante a los miembros del XI Congreso Internacional Ferrocarriles, Madrid, Mayo, 1930.

Un vol. (15 × 22 cm.) 216 pâginas y numerosos grabados. Artes Gráficas. Sucesores de Rivadeneyra (S. A.). Madrid, Paseo de San Vicente, 20.

1930 721 .9

MARTÍN DE LA ESCALERA (F.).

Cálculo elemental y ejecución de las obras de hormigón armado.

Ceuta-Tetuán, Imp. Tropas Coloniales. Un vol. (15 × 21 cm.), 418 páginas con 171 figuras en el texto y 9 ábacos. (Precio : 15 pesetas.)

[016 .385. (05]

II. — PERIODICALS.

In French.

Annales des Ponts et Chaussées. (Paris.)

1930 621 .33 (.44)

nnales des ponts et chaussées, mai-juin, p. 201.

MOREAU. — Un **réseau moderne d'intérêt local** : le seau de Champagnole. (10 000 mots, tableaux & fig.)

Bulletin de la Société des Ingénieurs civils de France. (Paris.)

1930 385. (09 (.44)

ull. de la Soc. des Ing. civ. de France, mai-juin, p. 392.

MOUTIER (A.). — **Chemins de fer.** (Extrait de moire présenté aux fêtes du Cinquantenaire de la fonation de l'American Society of Mechanical Engineers.) 000 mots.)

1930 624 .5

ull. de la Soc. des Ing. civ. de France, mai-juin, p. 475.

LEINEKUGEL LE COCQ (G.). — La standardisation les progrès des **ponts suspendus** modernes. (3 500 ots & fig.)

Annales des travaux publics de Belgique. (Bruxelles.)

1930 62. (01 & 691

nnales des travaux publics de Belgique, juin, p. 397.

DUTRON (R.). — Quelques considérations et echerches sur l'élasticité du béton à la compression. 300 mots, tableaux, planches & fig.)

1930 624. (0

nnales des travaux publics de Belgique, juin, p. 441.

VIERENDEEL (A.). — **Aciers pour ponts.** (3 000 ots, tableaux & fig.)

Arts et Métiers. (Paris.)

1930 385. (01 (.6)

rts et Métiers, juillet, p. 273.

Etat actuel des études sur le Transsaharien. (2 500 ots & carte.)

1930 621 .43

Arts et Métiers, juillet, p. 302.

MARCOTTE (E.). — **Suralimentation** des moteurs Diesel à l'aide de l'énergie des gaz d'échappement. (1 400 mots & figure.)

1930 621 .43

Arts et Métiers, août, p. 331.

DAMBROVSKI. — **Remarques** sur le moteur à combustion à grande vitesse. (2 000 mots, tableaux & fig.)

Bulletin technique de l'Union professionnelle des inspecteurs techniques et des chefs de section des chemins de fer belges. (Bruxelles.)

1930 656 .253

Bull. techn. de l'Union profes. des insp. tech. et des chefs de section des ch. de fer belges, n° 41, 15 sept., p. 1.

DEWILDE. — Au sujet du mécanisme de manœuvre des **sémaphores avertisseurs à trois positions** précédant un chandelier de bifurcation. (900 mots & fig.)

1930 625 .142.3

Bull. techn. de l'Union profes. des insp. tech. et des chefs de section des ch. de fer belges, n° 41, 15 sept., p. 4.

GILSON (E.). — Les **traverses métalliques. Leur ennemie : la cendrée.** (600 mots.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1930 313 .385 (.47)

Bull. des transp. intern. par ch. de fer, août, p. 403.

Statistique des Chemins de fer lithuaniens de l'Etat pour l'exercice 1928. (600 mots & tableau.)

Bulletin de l'Union internationale des chemins de fer. (Paris.)

1930 656 .225 (.43)

Bull. de l'Union intern. des ch. de fer, juillet, p. 247.

HOLLFELDER. — Le « **Leig** » (train léger de marchandises). (4 500 mots.)

1930 385 .113 (.43)
Bull. de l'Union intern. des ch. de fer, juillet, p. 253.
LEVERVE (Gaston). — **Rapport** du commissaire des chemins de fer allemands sur le cinquième exercice de fonctionnement de la Compagnie 1er janvier-31 décembre 1929 (suite et fin). (3 000 mots & tableaux.)

1930 651 (.43)
Bull. de l'Union intern. des ch. de fer, juillet, p. 268.
SCHROEDER (Dr. v.). — Les **recherches** du rendement de l'exploitation à la Deutsche Reichsbahn. (3 500 mots.)

Chronique des transports. (Paris.)

1930 385 .113 (.43)
Chronique des transports, n° 15, 10 août, p. 5.
Le onzième et dernier rapport du commissaire des **chemins de fer allemands.** (2 100 mots.)

1930 385. (09 (.460)
Chronique des transports, n° 16, 25 août, p. 4.
Les **chemins de fer de l'Espagne.** (1 600 mots.)

1930 656 .25 (.44)
Chronique des transports, n° 17, 10 septembre, p. 3.
La **nouvelle signalisation** des chemins de fer en France. (1 000 mots.)

1930 656 .2 (.43)
Chronique des transports, n° 17, 10 septembre, p. 9.
Le **problème du trafic** et la rationalisation des moyens de transport en Allemagne. (1 000 mots.) (A suivre.)

Génie civil. (Paris.)

1930 656 .211.5 (.44)
Génie civil, n° 2503, 2 août, p. 114.
Les **nouveaux aménagements** de la gare Saint-Lazare, à Paris. (1 000 mots & fig.)

1930 625 .5 (.44)
Génie civil, n° 2504, 9 août, p. 125.
LÉVY-LAMBERT (A.). — Le **funiculaire** du plateau de la Californie, à Cannes (Alpes maritimes). (2 800 mots & fig.)

1930 625 .1 (.45)
Génie civil, n° 2504, 9 août, p. 133.
TIAN (G.). — Le **chemin de fer** du nouvel Etat du Vatican, à Rome. (1 400 mots & fig.)

1930 625 .112 (.44 + .460)
Génie civil, n° 2504, 9 août, p. 137.
Les **travaux d'aménagement** à voie normale de la ligne espagnole Puigcerda-Barcelone. (1 100 mots & fig.)

1930 621 .8 (.494)
Génie civil, n° 2505, 16 août, p. 149.
Le **nouveau hall de montage** et la plateforme d'essais pour machines électriques des Usines Brown, Boveri et Cie, à Baden (Suisse). (3 000 mots & fig.)

1930
Génie civil, n° 2506, 23 août, p. 176; n° 2507, 30 août, p. 208.
DELANGHE (G.). — Les **machines à équilibrer** dynamiquement les pièces tournantes. (4 000 mots & fig.)

1930 621
Génie civil, n° 2507, 30 août, p. 205.
MONTEIL (C.). — Le **moteur Hesselman,** à gas et à faible pression. (1 800 mots & fig.)

1930 625 .14
Génie civil, n° 2507, 30 août, p. 212.
KATEL (I.). — **L'isolement acoustique dans les chemins de fer.** (1 100 mots & fig.)

1930 385. (09.1 (.8
Génie civil, n° 2508, 6 septembre, p. 226.
MILLOT (L.). — Les **chemins de fer** de la Colomb (3 500 mots & fig.)

1930 625 .5 (.4
Génie civil, n° 2508, 6 septembre, p. 235.
Le **funiculaire** du plateau de la Californie, à Cann **Calcul du travail utile du moteur.** (800 mots & fig.)

1930 625 .617 (.4
Génie civil, n° 2508, 6 septembre, p. 237.
Truck transporteur à voie normale, pour wagons voie étroite. (450 mots & fig.)

1930 669
Génie civil, n° 2509, 13 septembre, p. 254.
SEIGLE (J.). — Effets de la **trempe** à l'eau sur aciers doux. (2 600 mots & fig.)

1930 625 .1 (.4
Génie civil, n° 2510, 20 septembre, p. 274.
La **ligne directe** de Bologne à Florence (Italie). grand tunnel de l'Apennin. (2 700 mots, 1 tableau fig.)

1930 62. (
Génie civil, n° 2510, 20 septembre, p. 278.
BATICLE (E.). — Quelques aspects du problème **flambement.** (2 000 mots & fig.)

La Science et la Vie. (Paris.)

1930 621 .133
La Science et la Vie, août, p. 137.
LUCAS (P.). — Sur les locomotives, l'emploi **charbon pulvérisé** est économique et pratique. (1 3 mots & fig.)

1930 625 .4 (.44
La Science et la Vie, septembre, p. 232.
BODET (J.). — Ce que sera demain le **Métropolita** de Paris. (2 000 mots & fig.)

1930 656 .211 (.44)
Science et la Vie, octobre, p. 332.
MARIVAL (J.). — Les **nouveaux aménagements de** gare Saint-Lazare à Paris. (1 000 mots & fig.)

La Traction Electrique. (Pontoise-Paris.)

1929-1930 621 .335 (.54)
Traction électrique, décembre 1929-janvier 1930, p. 3.
HUG (Ad.-M.). — Les locomotives électriques à ande vitesse du Great Indian Peninsula Railway. 900 mots & fig.)

1929-1930 625 .215
Traction électrique, décembre 1929-janvier 1930, p. 12.
WORMS (J.). — **Bogies brill** pour automotrices et itures de chemins de fer. (2 300 mots & fig.)

1930 621 .33 (.460)
Traction électrique, février-mars, p. 54; avril-mai, p. 74.
VAN DER HULST (L.). — **Electrification partielle** réseau de la Compagnie générale de chemins de fer talans. (11 000 mots, tableaux & fig.)

1930 621 .132.8 (.44)
Traction électrique, février-mars, p. 62.
DELSAUX (J.). — Les **nouvelles automotrices** de la gie départementale des chemins de fer et tramways s Bouches-du-Rhône (Ligne de Marseille à Aix). 100 mots & fig.)

1930 621 .335 (.494)
Traction électrique, février-mars, p. 65.
HUG (Ad.-M.). — Les **nouvelles super-locomotives** ctriques d'essai pour tout service des chemins de fer léraux suisses pour la ligne du St. Gothard. (1 600 ts & fig.)

1930 621 .132.8 (.494)
Traction électrique, avril-mai, p. 86.
RUEGGER (U. R.). — Les **nouvelles automotrices** esel-électriques employées sur les chemins de fer isses. (2 200 mots & fig.)

Les chemins de fer et les tramways. (Paris.)

1930 621 .335 & 621 .43
s chemins de fer et les tramways, juillet, p. 124.
SPIESS (E.). — **Locomotive Diesel-électrique.** (3 200 ts & fig.)

1930 621 .132.8
s chemins de fer et les tramways, juillet, p. 127.
Automotrice articulée à vapeur. (300 mots & fig.)

1930 656 .212.8
s chemins de fer et les tramways, juillet, p. 129.
DUCHESNOY. — **Le pesage automatique.** (2 200 mots fig.)

1930 621 .134.5
Les chemins de fer et les tramways, juillet, p. 133.
Graissage sous pression pour la **lubrification des têtes de bielles** des locomotives. (1 800 mots & fig.)

1930 621 .138.3
Les chemins de fer et les tramways, juillet, p. 135.
Appareil pour le **nettoyage des locomotives.** (2 200 mots & fig.)

1930 625 .251
Les chemins de fer et les tramways, juillet, p. 138.
Perfectionnement aux **triples-valves à action rapide.** (2 700 mots & fig.)

1930 656 .211 (.44)
Les chemins de fer et les tramways, août, p. 146.
Les **Chemins de fer de l'Etat** et la Région parisienne. (1 600 mots.)

1930 669
Les chemins de fer et les tramways, août, p. 148.
Le rôle du **nickel** dans la construction du matériel des chemins de fer. (3 200 mots.)

1930 625 .245 & 621 .392
Les chemins de fer et les tramways, août, p. 151.
Véhicule équipé avec une génératrice de courant pour la **soudure des voies.** (1 000 mots & fig.)

1930 621 .137.1
Les chemins de fer et les tramways, août, p. 152.
Dispositif d'entraînement des mécanismes de **chauffe automatique des locomotives.** (1 100 mots & fig.)

1930 625 .17 & 621 .392
Les chemins de fer et les tramways, septembre, p. 155.
Soudure des rails sans interruption du trafic. (600 mots & fig.)

1930 656 .253
Les chemins de fer et les tramways, septembre, p. 157.
Ferrures pour montage de poulie de renvoi de mouvement dans les **transmissions de signaux.** (900 mots & fig.)

1930 621 .43
Les chemins de fer et les tramways, septembre, p. 158.
Perfectionnements aux procédés d'alimentation des moteurs électro-thermiques des **locomotives électro-thermiques.** (700 mots & fig.)

1930 625 .212
Les chemins de fer et les tramways, septembre, p. 161.
Dispositif pour réaliser la **convergence des essieux.** (1 000 mots & fig.)

1930 656 .256.3
Les chemins de fer et les tramways, septembre, p. 162.
Dispositif de **contrôle du franchissement** par un train d'un signal de bloc à l'arrêt. (1 000 mots & fig.)

1930 625 .151
Les chemins de fer et les tramways, septembre, p. 164.
Aiguillage automatique manœuvré électriquement de la voiture motrice. (1 600 mots & fig.)

1930 621 .134.3
Les chemins de fer et les tramways, septembre, p. 166.
Locomotive à haute pression à surchauffe intermédiaire. (1 100 mots & fig.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1930 625 .62
L'Ind. voies ferrées et transp. autom., juillet, p. 142.
JOURNÉ. — L'**organisation** des services d'approvisionnements dans une Société de Transports en Commun. (15 000 mots, tableaux & fig.)

1930 625 .62
L'Ind. voies ferrées et transp. autom., août, p. 191.
LIÈVRE. — Equipements à **récupération** d'énergie pour tramways. (16 000 mots & fig.)

Le progrès scientifique et industriel. (Douai.)

1930 621 .112
Le progrès scientifique et industriel, n° 15, juin, p. 425.
La question des hautes pressions de vapeur. (5 500 mots & fig.)

Revue politique et parlementaire. (Paris)

1930 625 .6 & 656 .1
Revue politique et parlementaire, 10 août, p. 304.
COLSON (C.). — Chemins de fer d'intérêt local, tramways et automobiles. Les programmes d'outillage national. (400 mots.)

Revue générale des chemins de fer. (Paris.)

1930 385 .587 (.44)
Revue générale des chemins de fer, août, p. 117.
LASSAIGNE. — **Note** sur la constitution des demi-accouplements de frein de 610 mm. aux ateliers de Noisy-le-Sec. (400 mots & fig.)

1930 625 .234
Revue générale des chemins de fer, août, p. 121.
FERRAND (A.). — **Coupleur** pour canalisation principale de chauffage électrique des voitures. (1 100 mots & fig.)

1930 725 .33
Revue générale des chemins de fer, août, p. 130.
MONTANDON. — **Utilisation rationnelle** de la lumière du jour pour l'éclairage des ateliers. (1 100 mots & fig.)

1930 385 .587 (.4
Revue générale des chemins de fer, septembre, p. 1
LESCŒUR. — **L'emploi** du travail à la chaîne da les ateliers de matériel roulant de la Compagnie Chemins de fer de l'Est. Note sur le bridage des colli de ressorts. (600 mots & fig.)

1930 385 .113 (.4
Revue générale des chemins de fer, septembre, p. 1
Les **résultats** de l'exploitation des cinq grandes Co pagnies de chemin de fer en 1929. (7 600 mots & bleaux.)

1930 385. (01 (.
Revue générale des chemins de fer, septembre, p. 2
Le **rapport** de l'organisme d'études du chemin de transsaharien. (5 000 mots & cartes.)

1930 625 .245 (.4
Revue générale des chemins de fer, septembre, p. 2
TÊTE. — Nouveaux **wagons à primeurs** des Chem de fer de Paris à Lyon et à la Méditerranée. (600 m & fig.)

Revue Universelle des Mines. (Liége.)

1930 625 .14
Revue universelle des mines, n° 6, 15 septembre, p. 1
HOUBAER (E.). — **Rails fabriqués au four électriq** (2 200 mots.)

1930 669
Revue universelle des mines, n° 6, 15 septembre, p. 1
MARECHAL (J. R.). — Les récents progrès des fo de fusion dans la **fonderie de fer.** (4 500 mots, 2 tablea & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1930 656 .23
Archiv für Eisenbahnwesen, Juli-August, S. 851.
SPIESS (Dr. W.). — **Tarif,** eine enzyklopädis Studie. (14 500 Wörter.)

1930 656 .235.5 (.4
Archiv für Eisenbahnwesen, Juli-August, S. 899.
RAUSCH (Dr. P.). — Der **Rohstofftarif** der deutsch Bahnen und seine wirtschaftliche Bedeutung. (11 Wörter & Tafeln.)

1930 385. (09 (.57 + .5
Archiv für Eisenbahnwesen, Juli-August, S. 939.
SALLER (Dr.). — Die **Turkestan**-sibirische Ba (2 700 Wörter, Karte & Abbildung.)

1930 385. (09 (.5
Archiv für Eisenbahnwesen, Juli-August, S. 951.
MARIA CREMER (Dr.). — Zur **Lage** der Ostchi sischen Bahn. (900 Wörter & Tabellen.)

1930 385 .517 (.43)
Archiv für Eisenbahnwesen, Juli-August, S. 969.
KUHATSCHECK (O.). — Die **Kranken- und Arbeiter-pensionskassen,** die Angestellten-, Unfall- und Arbeits-losenversicherung bei der Deutschen Reichsbahn im Jahr 1929. (2 100 Wörter & Tabellen.)

1930 385 .113 (.436)
Archiv für Eisenbahnwesen, Juli-August, S. 1017.
ROESNER (Dr. E.). — Die **Osterreichischen** Bundes-bahnen im Jahr 1928. (600 Wörter & Tafeln.)

1930 385 .113 (.439)
Archiv für Eisenbahnwesen, Juli-August, S. 1043.
RAJZ (K.). — Die **Königlich Ungarischen** Staats-bahnen im Betriebsjahr 1927-1928. (400 Wörter & Tafeln.)

1930 313 .385 (.42)
Archiv für Eisenbahnwesen, Juli-August, S. 1063.
Die Eisenbahnen Grossbritanniens 1927 und 1928. Tafeln.)

Elektrische Bahnen. (Berlin.)

1930 621 .335 (.433)
Elektrische Bahnen, Augustheft, S. 233.
KLEINOW (W.). — Die **Lokomotiven** der Bayerischen Zugspitzbahn. (5 300 Wörter & Abb.)

1930 621 .33 (.43)
Elektrische Bahnen, Augustheft, S. 242.
FLEISCHHAMMER (E.). — **Besondere Einrichtungen** der Vielfachsteuerung für die Triebwagenzüge auf den bayerischen Strecken der Deutschen Reichsbahn. (2 300 Wörter & Abb.)

1930 621 .33
Elektrische Bahnen, Augustheft, S. 255.
KOEPPEN (Dr. H.). — Die **Kriterien** wirtschaft-lichster Geschwindigkeiten bei elektrischen Bahnen. (1 600 Wörter & Abb.)

1930 621 .33 (.65)
Elektrische Bahnen, Septemberheft, S. 265.
GELBER (Dr. F.). — Die **Elektrisierung** der alge-rischen Staatsbahnen. (7 300 Wörter & Abb.)

1930 621 .33
Elektrische Bahnen, Septemberheft, S. 287.
ALZMANN (M.). — **Anordnung** und **Aufbau** von Schutzstrecken für Fahrleitungen. (1 200 Wörter & Abb.)

1930 625 .245 & 625 .172
Elektrische Bahnen, Septemberheft, S. 291.
SCHWUB (C. W.). — **Schienenschleifwagen** mit rotie-renden Scheiben zur Riffelbeseitigung. (1 000 Wörter & Abb.)

Elektrotechnische Zeitschrift. (Berlin.)

1930 621 .33 (.54)
Elektrotechnische Zeitschrift, Heft 32, 7. Aug., S. 1135.
STRITZL (Dr. von). — Die **Elektrisierung** der bri-tisch-indischen Bahnen. (1 100 Wörter, Tafeln & Abb.)

1930 654
Elektrotechnische Zeitschrift, Heft 38, 18. Sept., S. 1323.
BEIER (E.). — Der **Springschreiber** T-30. Die Fern-schreibmaschine der Siemens & Halske A. G. (3 000 Wörter & Abb.)

1930 625 .4 (.83)
Elektrotechnische Zeitschrift, Heft 38, 18. Sept., S. 1329.
GELDERMANN (A.). — **Verkehrsentwicklung** und Untergrundbahn-Unternehmungen in Buenos Aires. (2 900 Wörter & Karte.)

Glasers Annalen. (Berlin.)

1930 651 (.43)
Glasers Annalen, Nr. 1274, 15. Juli, S. 17.
SCHMELZER. — Die **Seilpostanlage** für den Akten-verkehr im Reichsbahn-Zentralamt, Berlin. (2 500 Wör-ter & Abb.)

1930 621 .33 (.436)
Glasers Annalen, Nr. 1275, 1. August, S. 32.
HEYDMANN. — Die **Elektrisierung** der Oester-reichischen Bundesbahnen. (4 500 Wörter & Abb.)

1930 621 .133.1
Glasers Annalen, Nr. 1275, 1. August, S. 38.
PROCKAT (Fr.). — **Beiträge zur Kohlenstaubfrage.** II. Abscheidung von Staub aus waagerechten Gasströ-men. (1 900 Wörter, Tabellen & Abb.)

1930 621 .133.1
Glasers Annalen, Nr. 1275, 1. August, S. 43; Nr. 1276, 15. August, S. 47.
PROCKAT (Fr.). — **Beiträge zur Kohlenstaubfrage.** III. Trennung von Staubgasgemischen durch Fliehkraft. (3 400 Wörter, Tabellen & Abb.)

1930 62. (04 (.43)
Glasers Annalen, Nr. 1275, 1. August, S. 56.
Zweite Weltkraftkonferenz Berlin 1930. (3 000 Wörter.)

1930 621 .33 (.494)
Glasers Annalen, Nr. 1277, 1. September, S. 63.
PETERS. — **Mitteilungen** über die Elektrisierung der Schweizerischen Bahnen insbesondere der Schweize-rischen Bundesbahnen. (2 500 Wörter, Tafeln & Abb.)

In English.

Electric Railway Journal. (New York.)

1930 388 (.73)
Electric Railway Journal, August, p. 500.
Chicago to have immense **transportation development.** (4 100 words & fig.)

1930 621 .332 (.73) & 621 .336 (.73)
Electric Railway Journal, August, p. 507.
BARDO (B. F.). — Maintaining the **distribution sys-tem of an electrified railroad** (New York, New Haven & Hartford). (2 800 words, 3 tables & fig.)

1930 621 .335 (.436)
Electric Railway Journal, August, p. 511.
Vertical motors feature Austrian electric locomotives built for high-speed passenger service; twin motors drive individual axles through bevel gears. (700 words, 1 table & fig.)

1930 385 .517.1 (.73)
Electric Railway Journal, August, p. 515.
Employee pension plan analyzed. (5 000 words & fig.)

1930 621 .335 (.73)
Electric Railway Journal, August, p. 524.
PERKINSON (T. F.). — **Double-voltage operation** features Midland **utilities locomotive.** (1 200 words, 1 table & fig.)

1930 388 (.45) & 625 .4 (.45)
Electric Railway Journal, August, p. 526.
VALLECCHI (Ugo). — Rome to have modern **subway.** (3 700 words, tables & fig.)

1930 625 .25 (.73)
Electric Railway Journal, September, p. 562.
New **braking apparatus** demonstrated. (700 words & table.)

1930 621 .338 (.43)
Electric Railway Journal, September, p. 572.
Articulated cars tested in Dresden. (1 200 words & fig.)

1930 621 .331 (.71)
Electric Railway Journal, September, p. 577.
ANGELIS (M. G. de). — Montreal Tramways install third **automatic rectifier substation** (mercury arc). (2 300 words & fig.)

Engineer. (London.)

1930 624 .51 (.73)
Engineer, No. 3890, 1 August, p. 110.
The Hudson River **bridge.** (2 800 words & fig.)

1930 621 .116
Engineer, No. 3890, 1 August, p. 125.
The reduction of **ash discharged by smokestacks.** (1 600 words & 3 tables.)

1930 621 .132.3 (.42)
Engineer, No. 3891, 8 August, p. 149.
Locomotive No. 10 000 (High-pressure, London & North Eastern Railway). (1 000 words.)

1930 621 .94 (.42)
Engineer, No. 3892, 15 August, p. 169.
Double-ended **axle journal regrinding machine.** (1 300 words & fig.)

1930 385 .11 (.42)
Engineer, No. 3892, 15 August, p. 176.
The **railway position.** (1 700 words.)

1930 621 .85 (.
Engineer, No. 3892, 15 August, p. 182.
A new form of **factory truck.** (800 words & fig.)

1930 621 .94 (.
Engineer, No. 3893, 22 August, p. 198.
Railway carriage and wagon **wheel lathe.** (900 wo & fig.)

1930 621 .133.5 (.
Engineer, No. 3893, 22 August, p. 201.
A duplex chimney locomotive. (500 words & fig.)

1930 656 .254 (.
Engineer, No. 3894, 29 August, p. 224.
London Midland & Scottish Railway **telegraphs.** (5 words & fig.)

1930 621 .13
Engineer, No. 3894, 29 August, p. 229.
The rival systems of **pulverised coal burning.** (2 words & fig.)

1930 621
Engineer, No. 3894, 29 August, p. 236.
5-ton **overhead travelling crane** with ball bearin (1 000 words & fig.)

1930 669
The Metallurgist, Supplement to The Engineer, No. 38 29 August, p. 116.
Hot-working and the critical points of **steel.** (8 words & fig.)

1930 669
The Metallurgist, Supplement to The Engineer, No. 38 29 August, p. 123.
The **iron-manganese** system. (1 700 words & fig.)

1930 621 .3
The Metallurgist, Supplement to The Engineer, No. 38 29 August, p. 126.
Electric welding. (1 100 words.)

1930 621
Engineer, No. 3895, 5 September, p. 247.
Cutting tests with cemented tungsten-carbide lat **tools** (American Society of Mechanical Engineer (4 000 words, tables & fig.)

1930 6
Engineer, No. 3895, 5 September, p. 256.
ELGOOD (W. Nelson). — Aesthetics in **metal brid design.** (1 800 words.)

1930 669 .1 (06 (.4
Engineer, No. 3897, 19 September, p. 305.
The **Iron and Steel Institute.** Autumn meeting Prague. — No. 1. (3 000 words & fig.)

1930 656 .281 (.4
Engineer, No. 3897, 19 September, p. 307.
Derailments of express locomotives. (2 000 words fig.)

1930 385. (064 (.42) & 385 .09 (.42)
Engineer, No. 3897, 19 September, p. 315.
The **Centenary of the Liverpool and Manchester Railway.** (1 000 words.)

Engineering. (London.)

1930 625 .4 (.436)
Engineering, No. 3368, 1 August, p. 133.
The Triest-Opicina **mountain railway.** (2 900 words & fig.)

1930 621 .116 (.73)
Engineering, No. 3368, 1 August, p. 150.
The **removal of ash from flue gases.** (1 200 words & fig.)

1930 536
Engineering, No. 3369, 8 August, p. 177; No. 3370, 15 August, p. 193.
FISHENDEN (Margaret) and SAUNDERS (O. A.). — **The calculation of convection heat transfer.** (6 000 words, tables & fig.)

1930 624 .63 (.73)
Engineering, No. 3370, 15 August, p. 196.
ROSS (T. A.). — The Raritan **river bridge,** New Jersey. (1 600 words & fig.)

1930 721 .3 & 725 .3
Engineering, No. 3370, 15 August, p. 201.
The **righting of the Skegness water tower.** (450 words & fig.)

1930 621 .138.3 (.73)
Engineering, No. 3370, 15 August, p. 217.
Sand-blast locomotive boiler tube scaler. (500 words & fig.)

1930 621 .133.7
Engineering, No. 3370, 15 August, p. 218.
Water softening by base exchange. (1 100 words.)

1930 624 .62 (.73)
Engineering, No. 3371, 22 August, p. 227.
The substructure of the Kill van Kull **bridge,** New York. (2 200 words & fig.)

1930 625 .245
Engineering, No. 3371, 22 August, p. 230.
Railway **rolling stock** at the Liége Exhibition. (1 200 words & fig.)

1930 621 .33 (.73) & 625 .4 (.73)
Engineering, No. 3372, 29 August, p. 257.
SKINNER (F. W.). — New York Electric **Subway construction methods.** — I. (3 100 words.)

1930 621 .138.5 & 625 .26
Engineering, No. 3372, 29 August, p. 269.
The **organisation of workshops.** (1 800 words.)

1930 669
Engineering, No. 3372, 29 August, p. 280.
The physical and mechanical **properties of metals** (Brief outlines of papers and reports, Meeting of the A. S. T. M., 23-27 June). (4 500 words & fig.)

1930 621 .165
Engineering, No. 3373, 5 September, p. 283.
DARRIEUS (G.). — The rational definition of **steam turbine efficiencies.** (3 700 words & fig.)

1930 621 .132.3 (.54)
Engineering, No. 3373, 5 September, p. 295.
4-6-2 type locomotives for the Indian State Railways. (400 words & fig.)

1930 621 .133.1 (.73)
Engineering, No. 3373, 5 September, p. 314.
Coal-ash fusion test. (600 words & fig.)

1930 385. (064 (.42) & 385. (09 (.42)
Engineering, No. 3375, 19 September, p. 367; No. 3376, 26 September, p. 403.
The **Centenary of the Liverpool and Manchester Railway.** (3 300 words.)

1930 669 .1 (06 (42)
Engineering, No. 3375, 19 September, p. 367.
The **Iron and Steel Institute.** Prague Meeting (to be continued). (3 000 words.)

1930 621 .133.1
Engineering, No. 3375, 19 September, p. 380.
FOWLER (Sir Henry). — **Consumption of fuel in locomotive practice.** (2 600 words.)

1930 625 .13 (.73)
Engineering, No. 3376, 26 September, p. 383.
BAKER (A. R.). — The Oakland-Alameda Estuary **Tube.** (4 500 words & fig.)

1930 624. (0
Engineering, No. 3376, 26 September, p. 399.
The proportioning of **bridgework.** (2 800 words.)

1930 669 .1
Engineering, No. 3376, 26 September, p. 400.
Modern **metal cutting tools.** (1 500 words & fig.)

1930 625 .245
Engineering, No. 3376, 26 September, p. 412.
120-ton crocodile wagon for electrical machinery, Great Western Railway. (350 words & fig.)

Engineering News-Record. (New York.)

1930 625 .4 (.73)
Engineering News-Record, 7 August, p. 199.
New York **Subway engineering** progress. (800 words.)

1930 **625 .4 (.73)**

Engineering News-Record, 7 August, p. 200.

New York **Subway construction.** — I. Major construction problems and developments in New York's latest subways. (4 400 words, 1 map & fig.)

1930 **624 .51 (.73)**

Engineering News-Record, 14 August, p. 242.

BOWDEN (E. Warren). — Spinning four 36-inch **cables for the Fort Lee bridge.** (6 000 words & fig.)

1930 **624 .0 (.43) & 669 .1 (.43)**

Engineering News-Record, 14 August, p. 253.

Special steel reduces weight of 935-foot girder bridge. (400 words & fig.)

1930 **51**

Engineering News-Record, 14 August, p. 254.

LLEWELLYN (F. T.). — **Solving cubic and quartic equations.** Development of a practical method for use in every-day structural design. (3 000 words & fig.)

1930 **656 .212.8 (.73)**

Engineering News-Record, 14 August, p. 257.

High-capacity **track scale for weighing locomotives.** (1 000 words & fig.)

1930 **624 .63 (.73)**

Engineering News-Record, 21 August, p. 290.

Oregon highway **bridge** to be built by Freyssinet method. (1 100 words & fig.)

1930 **624 .63 (.73)**

Engineering News-Record, 21 August, p. 291.

THOMPSON (J. T.). — Stresses under the Freyssinet method of **concrete-arch construction.** (800 words & table.)

1930 **624**

Engineering News-Record, 28 August, p. 318.

Guy-derrick erection of **steel bridges and viaducts.** (3 600 words & fig.)

1930 **721 .1 (.73)**

Engineering News-Record, 4 September, p. 363.

Deep **foundations** at Cleveland Union Station. (900 words.)

1930 **55 (.73) & 621 .39 (.73)**

Engineering News-Record, 4 September, p. 364.

CARPENTER (E. E.) and LEONARDON (E. G.). — **Geophysical study predicts rock conditions at tunnel site.** (1 100 words.)

1930 **624 .1 (.73)**

Engineering News-Record, 4 September, p. 366.

Corrugated steel shells in bored holes form new type **pier foundation** on Pennsylvania Railroad's bridge. (1 200 words & fig.)

1930 **625 .4 (.73)**

Engineering News-Record, 4 September, p. 371.

New York **Subway construction.** — II. Street staging and decking for open-cut subway. (2 700 words & fig.)

1930 **621 .133**

Engineering News-Record, 11 September, p. 398.

BURDICK (Charles B.). — **Groundwater as a sour** of supply. (3 000 words & fig.)

1930 **621 .133**

Engineering News-Record, 11 September, p. 406.

SPURR WESTON (Robert). — Importance an necessary treatment of **groundwater supplies.** (2 70 words & fig.)

1930 **621 .133**

Engineering News-Record, 11 September, p. 410.

Hard muddy **river water treated** in new purificatio plant at Saginaw, Michigan. (2 200 words & fig.)

1930 **621 .392 (.73) & 721**

Engineering News-Record, 18 September, p. 442.

Welding steel structures. — I. — Highest **all-welde office building** erected in Dallas. (700 words & fig. II. — Inspecting field-welding of structural steel, b W. F. Carson. (550 words & fig.). III. — A ration method of welded connection design, by A. Vogel. (1 00 words & fig.). IV. — Large area of welded steel floo in Pittsfield, Mass., garage, by E. N. Adams. (55 words & fig.) V. — Welding field joints on a fourteer story office building, by J. T. Whitney. (1 500 word 1 table & fig.). VI. — Arc-welding facts that shoul be common knowledge. (600 words & fig.)

1930 **625 .4 (.73**

Engineering News-Record, 18 September, p. 455.

New York **Subway construction.** — III. — Excava tion and support of structures on open-cut subwa (3 500 words & fig.)

1930 **624 .63 (.73) & 693 (.73**

Engineering News-Record, 25 September, p. 482.

COVELL (V. R.) and FREEMAN (P. J.). — **Winte construction of concrete bridges** on Ohio River Boul vard (Winter expedients and high-early-strengt cements). (2 500 words & fig.)

1930 **624**

Engineering News-Record, 25 September, p. 489.

Mc CULLOUGH (C. B.). — Derivation of theorie underlying **mechanical methods of stress analysis.** (1 30 words & fig.)

1930 **721 .1 (.73**

Engineering News-Record, 25 September, p. 496.

Foundation of fourteen-story building replaced unde basement floor. (2 400 words & fig.)

1930 **656 .212 (.73**

Engineering News-Record, 25 September, p. 499.

Reconstruction of Union stations at Omaka, Ne (1 200 words & fig.)

Great Western Railway Magazine. (London.)

1930 **385. (08 (.42**

Great Western Ry Magazine, January, p. 7.

The **past year's work in the principal Department** (of the Great Western Railway). (14 500 words & fig

1930 **656 .253 (.42 + .73)**
Great Western Ry Magazine, May, p. 203.
CROOK (G. H.). — **Speed signalling :** Could we adopt it? (4 200 words & fig.)

1930 **385 .517.6 (.42)**
Great Western Ry Magazine, July, p. 304.
LEAN (Florence M.). — 1. — The **railway convalescent home** at Dawlish. (800 words & fig.)

1930 **385 .517.6 (.42)**
Great Western Ry Magazine, August, p. 335.
LEAN (Florence M.). — The **railway convalescent homes.** No. 2. — The women's home at Margate. (800 words & fig.)

Journal of the Institution of Engineers, Australia. (Sydney.)

1930 **621 .331 (.944)**
Journal of the Inst. of Eng., Australia, July, p. 229.
WILSHIRE (J. R.). — Some features of design, and operating experiences of **1 500-volt railway substations.** New South Wales Government Railways, 1925-1930. (9 000 words, tables & fig.)

1930 **62. (01**
Journal of the Inst. of Eng., Australia, July, p. 247.
HAWKEN (R. W. H.). — The general equation of **stress in frictional-cohesive material.** (8 000 words & fig.)

1930 **621 .392 & 669 .1**
Journal of the Inst. of Eng., Australia, July, p. 258.
MOON (A. R.). — Control of quality in **electrically welded steel structures.** (6 500 words, 6 tables & fig.)

1930 **621 .31**
Journal of the Inst. of Eng., Australia, August, p. 277.
BATE (E.). — The vibration of **transmission line conductors.** (6 200 words, tables & fig.)

London & North Eastern Railway Magazine. (York.)

1930 **656 .212.5**
London & North Eastern Ry. Magazine, Sept., p. 441.
JENKIN JONES (C. M.). — **Marshalling yard operations** and statistics. (1 100 words & fig.)

Mechanical Engineering. (New York.)

1930 **621 .111**
Mechanical Engineering, No. 8, August, p. 748.
ORROK (Geo A.). — The economics of **high-pressure steam.** (1 500 words, 3 tables & fig.)

1930 **621 .116**
Mechanical Engineering, No. 8, August, p. 751.
STRACHAN (John E.). — Machining seamless forged **steel drums for high pressure work.** (3 200 words & fig.)

1930 **621 .165**
Mechanical Engineering, No. 8, August, p. 757.
CHRISTIE (A. G.). — Economic considerations in the application of modern **steam turbines** to power generation. (4 500 words & fig.)

1930 **016 .621.89 & 621 .89**
Mechanical Engineering, No. 8, August, p. 772.
HERSEY (M. D.). — **Lubrication** research. (2 600 words & fig.)

1930 **669 .1**
Mechanical Engineering, No. 8, August, p. 777.
SPENCER (F. C.). — Tungsten-carbide **cutting tools.** Progress report No. 2 of Subcommittee on tungsten-carbide cutting materials of the A. S. M. E. Special Research Committee on the cutting of metals. (4 100 words & fig.)

1930 **669**
Mechanical Engineering, No. 8, August, p. 788.
Casting **railway bronze bearings** in permanent molds. (600 words.)

1930 **621 .33**
Mechanical Engineering, No. 9, September, p. 821.
MORTON (R. B.). — Economics of **railway electrification.** (4 800 words & fig.)

1930 **62. (01**
Mechanical Engineering, No. 9, September, p. 839.
SEELY (Fr. B.). — The statistical element in **mechanics of materials.** (3 800 words & fig.)

1930 **621 .143.3**
Mechanical Engineering, No. 9, September, p. 863.
Measurement of **rail-head wear.** (700 words & fig.)

Modern Transport. (London.)

1930 **621 .13 & 621 .43**
Modern Transport, 2 August, p. 3.
Steam and Diesel-electric locomotives. Standards of comparison. (3 000 words.)

1930 **656 .2**
Modern Transport, 2 August, p. 7; 9 August, p. 7; 16 August, p. 5; 23 August, p. 7; 30 August, p. 11; 13 September, p. 5; 20 September, p. 5; 27 September, p. 9.
HARE (T. Bernard). — Practical **railway operation.** Nos. 18 to 25. (10 000 words, tables, diagrams & fig.)

1930 **624 .62 (.66)**
Modern Transport, 9 August, p. 3.
The new **bridge** over the River Nile. Constructional progress at Jinga, East Africa. (1 400 words & fig.)

1930 621 .133.1
Modern Transport, 9 August, p. 5.
RICKIE (J.). — Experiments in **fuel economy.** A slow-combustion **locomotive steam generator.** (1 800 words & fig.)

1930 621 .13 & 621 .33
Modern Transport, 9 August, p. 9.
FUCHS (F.) and WECHMANN (W.). — **Steam and electrically-operated railways.** Review of recent developments. (1 700 words & fig.)

1930 621 .138
Modern Transport, 16 August, p. 3.
Maintenance of transport units. Standardisation of production methods. (1 500 words.)

1930 385 (01 (.5)
Modern Transport. 16 August, p. 4.
Development of Central Asia. Possible effects of **Tur-Sib and Afghan railways.** (1 200 words.)

1930 625 .235 (.73)
Modern Transport, 16 August, p. 7.
Railway rolling stock innovation. « **Reclining seat cars** » for Baltimore and Ohio Railroad. (250 words & fig.)

1930 656 .211.7
Modern Transport, 16 August, p. 8.
Cross-Channel transport. The case for **train ferries.** (1 400 words.)

1930 621 .132.5 (.66)
Modern Transport, 23 August, p. 3.
Three **4-8-2 type 3-cylinder engines** for heavy traffic on narrow gauge lines (Nigerian Railway). (1 500 words & fig.)

1930 621 .335 & 621 .43
Modern Transport, 23 August, p. 9.
CHORLTON (A. E. L.). — **Diesel-electric traction.** Some further comparisons. (1 600 words.)

1930 621 .13, 621 .335 & 621 .43
Modern Transport, September 6, p. 3.
Steam and Diesel-electric locomotives. Some further comparisons. (1 100 words.)

1930 656 .225
Modern Transport, September 6, p. 5.
Perishable traffic in the Argentine. Insulated containers for the Buenos Ayres and Pacific Railway. (350 words & fig.)

1930 656 (.42)
Modern Transport, September 6, p. 9.
Progress of **transport in Great Britain.** An authoritative review of post-war development. (3 500 words & tables.)

1930 625 .232 (06 (.4)
Modern Transport, 13 September, p. 3.
A great international transport undertaking. **History and development of the « Wagons-Lits ».** (3 000 words & fig.)

1930 656 .212.5
Modern Transport, 13 September, p. 7.
JENKIN-JONES (C. M.). — **Marshalling yard operations.** Value of statistics. (1 100 words & fig.)

1930 656 (.43)
Modern Transport, 13 September, p. 21.
Transport co-ordination in Germany. Review of recent progress. (2 300 words.)

1930 656 .1 (.44) & 656 .2 (.44)
Modern Transport, 20 September, p. 7.
Road transport and the railways. Co-ordination problems in France. (1 600 words & fig.)

1930 656 (.460)
Modern Transport, 20 September, p. 11.
Transport developments in Spain. Progress in railway electrification. (1 400 words & fig.)

1930 621 .13 (0
Modern Transport, 27 September, p. 3.
KELWEY-BAMBER (H.). — Progress of **locomotive design.** Influence of road competition. (1 300 words & fig.)

1930 621 .133.1
Modern Transport, 27 september, p. 5.
FOWLER (Sir Henry). — **Consumption of fuel in locomotive practice.** Methods of effecting economy. (1 200 words & fig.)

Proceedings, Institution of Mechanical Engineers. (London.)

1930 62. (01, 621 .392 & 665 .882
Proceedings, Inst. Mech. Eng. No. 2, p. 319.
SCHUSTER (L. W.). — The strength and design of **fusion welds** for unfired pressure vessels. (23 000 words, tables & fig.)

1930 621 .18 (.42)
Proceedings, Inst. Mech. Eng., No. 2, p. 423.
NITHSDALE (William). — The design and results of a 600-lb. per sq. in. **boiler installation.** (11 500 words, tables & fig.)

1930 621 .18 (.44)
Proceedings, Inst. Mech. Eng., No. 2, p. 473.
CARNEGIE (Francis). — The economical **production and distribution of steam in large factories.** (15 000 words, tables, folded plates & fig.)

Railway Age. (New York.)

1930 656 .212 (.73)

Railway Age, 2 August, p. 224.

Chicago & North Western completes large freight erminal. (4 400 words & fig.)

1930 657 (.73)

Railway Age, 2 August, p. 230.

Lehigh Valley scraps its **stock book.** (1 400 words & fig.)

1930 625 .212 (.73

Railway Age, 2 August, p. 233.

New Haven baggage-mail cars equipped with **roller** bearings. (500 words & fig.)

1930 385 .517.1

Railway Age, 2 August, p. 236.

CLARK (J. C.). — **Funding railroad pension plans.** Reasons for — Advantages and disadvantages of different funding arrangements discussed. (2 800 words & fig.)

1930 625 .242 (.73)

Railway Age, 2 August, p. 239.

Fifty-ton **gondola cars** for Central of Georgia. (500 words & fig.)

1930 385

Railway Age, 2 August, p. 249.

HOWSON (Elmer T.). — **Railway future** presents many problems. Adoption of new machinery to be a vital factor in railroad progress during next ten years. (3 000 words & fig.)

1930 625 .234 (.73)

Railway Age, 9 August, p. 267.

Conditioned air for passenger cars (Baltimore & Ohio). (1 900 words & fig.)

1930 625 .16 (.73)

Railway Age, 9 August, p. 270.

Can a railway afford to **beautify its station grounds?** (2 400 words, 1 table & fig.)

1930 656 .222 (.73)

Railway Age, 9 August, p. 274.

New Haven analyzes **rail car operations.** (1 600 words & fig.)

1930 656 .253 (.73)

Railway Age, 9 August, p. 277.

Pennsylvania extends **cab signaling** on large mileage. (2 200 words & fig.)

1930 621 .132.8 (.43) & 621 .43 (.43)

Railway Age, 9 August, p. 280.

GEIGER (Jos.). — **Diesel locomotive with compressed air transmission** (German State Railways). (1 500 words & fig.)

1930 385. (072 & 62. (01

Railway Age, 9 August, p. 285.

Delaware, Lackawanna & Western depends more and more on **laboratory work.** (1 800 words & fig.)

1930 385

Railway Age, 16 August, p. 311.

LISMAN (F. J.). — A diagnosis of **railway ills.** (5 500 words & fig.)

1930 656 .257 (.73)

Railway Age, 16 August, p. 317.

STOLTZ (C. F.). — Big Four installs simplified **interlocking** with no mechanical locking. Illuminated diagram includes signal levers and moveable track sections repeating position of switches. (1 400 words & fig.)

1930 625 .1 (.73)

Railway Age, 16 August, p. 321.

Many achievements feature **new line** of the Pittsburgh to West Virginia. (4 100 words & fig.)

1930 621 .335 (.73) & 621 .4 (.73)

Railway Age, 16 August, p. 326.

BREHOB (F. H.). — **Oil-electric-battery locomotives** for the New York Central. (2 300 words & fig.)

1930 625 .215 (.73)

Railway Age, 16 August, p. 331.

Performance of 100-ton **car with four-wheel trucks.** (900 words & fig.)

1930 625 .122 (.73)

Railway Age, 23 August, Section one, p. 354.

Modern methods used in **grading.** (5 500 words & fig.)

1930 625 .234 (.73)

Railway Age, 23 August, Section one, p. 363.

Santa Fe operates first **air-cooled car** to Pacific Coast. (1 800 words & fig.)

1930 621 .4 (.73)

Railway Age, 23 August, Section two, p. 394.

ABELL (Carl). — The **motor coach engine.** — Yesterday, today, to morrow. (5 700 words & fig.)

1930 656 .1 & 656 .22

Railway Age, 23 August, Section two, p. 405.

Solving the problem of the **unprofitable train.** (2 400 words.)

1930 656 .1 (.73)

Railway Age, 23 August, Section two, p. 407.

Delaware Valley handles all **passenger traffic by motor coach.** (1 200 words & fig.)

1930 621 .133.7 (.73) & 725 .33 (.73)

Railway Age, 30 August, p. 430.

GRIME (E. M.). — New **treating plants** yield 30 per cent. (1 800 words & fig.)

1939 621 .139 (.73), 625 .18 (.73) & 625 .27 (.73)
Railway Age, 30 August, p. 434.
Competition yields ideas for better **supply work.** (3 400 words & fig.)

1930 656 .255 (.73)
Railway Age, 30 August, p. 439.
ZANE (W. F.). — Burlington installs **centralized traffic control on 24 miles of single track.** (1 500 words & fig.)

1930 625 .3 (.73)
Railway Age, 30 August, p. 443.
BEEM (H. J.). — **Operating a desert division.** Western Pacific overcomes handicaps of wind and sand through Nevada. (1 400 words & fig.)

1930 621 .132.8 & 621 .4
Railway Age, 30 August, p. 451.
LIPETZ (A. L.). — Economics of the **oil-engine locomotive.** (2 700 words, tables & fig.)

1930 625 .3 (.73)
Railway Age, 6 September, p. 475.
HACK (W. L.). — **Operating a mountain division.** Southern Pacific handles heavy traffic across the Sierra Nevadas. (1 300 words & fig.)

1930 621 .335 (.73) & 621 .338 (.73)
Railway Age, 6 September, p. 479.
MARTHENS (A. S.). — Improved **multiple-unit cars** placed in service by the New-Haven. (800 words & fig.)

1930 656 .212.6 (.73)
Railway Age, 6 September, p. 484.
Sawtooth trackage saves time in switching cars. (500 words & fig.)

1930 625 .2 (06 (.73)
Railway Age, 6 September, p. 489.
Car officers meet in Detroit. (3 500 words, table & fig.)

1930 621 .335
Railway Age, 6 September, p. 495.
TALIAFERRO (W. R.). — **Weight transfer compensation for electric locomotives.** (600 words & fig.)

1930 621 .138
Railway Age, 6 September, p. 496.
Drafto units for **blowing locomotives.** (700 words & fig.)

1930 625 .258 (.73) & 656 .254 (.73)
Railway Age, 13 September, p. 517.
Car retarders reduce cost of yard operation on the Chesapeake & Ohio. (1 200 words & fig.)

1930 621 .132.5 (.43)
Railway Age, 6 September, p. 519.
FUCHS. — Another high-pressure locomotive on German State Railways. (1 500 words, table & fig.)

1930 621 .335 (.73) & 621 .338 (.73
Railway Age, 13 September, p. 522.
Two-car units for Lackawanna electrification. (2 30 words & fig.)

1930 657 (.73
Railway Age, 13 September, p. 527.
Abbreviated abstracting aids stations. (1 000 words

1930 385. (072 (.73), 62. (01 (.73) & 625 .245 (.73
Railway Age, 13 September, p. 529.
HALL (M. A.). — Kansas City Southern expands tes **and inspection work.** (1 700 words & fig.)

1930 625 .13 (.73
Railway Age, 13 September, p. 533.
LANG, Jr. (P. G.). — Baltimore and Ohio reconstruct 63 **bridges.** (1 100 words & fig.)

1930 385 .57 (.73
Railway Age, 13 September, p. 535.
What shall we tell them? Should **railroad careers** b recommended to college men? (1 700 words.)

1930 725 .33 (.73
Railway Age, 20 September, p. 567.
Producing good water where there is none. (2 40 words & fig.)

1930 621 .132.8 (.73
Railway Age, 20 septembe", p. 571.
WHITFIELD (E. O.). — Economy in **rail car opera tion.** (2 200 words & fig.)

1930 65
Railway Age, 20 September, p. 576.
Taking the inventory of a $ 40 000 000 stock (Penn sylvania Railroad). (3 000 words & fig.)

1930 656 .25 (06 (08 (.73
Railway Age, 20 September, p. 583.
Signal section meets at Hot Springs. (6 000 words & fig.)

Railway Engineer. (London.)

1930 621 .132.8
Railway Engineer, March, p. 95.
New high-powered **Beyer-Garratt locomotives** fo India. (2 300 words & fig.)

1930 625 .258 (.44) & 656 .254 (.44)
Railway Engineer, March, p. 99.
Slipper-brakes in shunting yards. (2 600 words & fig.)

1930 625 .26 (.42) & 725 .45 (.42
Railway Engineer, March, p. 103.
New **wagon building layout** at Newton Heath, Lon don Midland & Scottish Railway. (2 700 words & fig.)

1930 625 .143.5 (.42)
ailway Engineer, March, p. 109.
Steel sleeper adjustment for flat-footed rails. (600 ords & fig.)

1930 656 .255
ailway Engineer, March, p. 110.
Starting signal control on single lines by the single ie token. (2 000 words & fig.)

1930 656 .21
ailway Engineer, March, p. 113.
HEARN (Sir Gordon). — **Roadside stations.** — III. 200 words & fig.)

1930 625 .233
ailway Engineer, March, p. 120.
COPPOCK (C.). — **Electric train lighting equipment.** - VI. (2 500 words & fig.)

1930 621 .133.1
ailway Engineer, March, p. 123.
ATKINSON (T. G.). — **Fuel conservation.** (3 000 ords & fig.)

1930 621 .138.5 (.42) & 625 .26 (.42)
ailway Engineer, August, p. 303.
Caerphilly **Locomotive, Carriage and Wagon Works,** reat Western Railway. (5 000 words, tables & fig.)

1930 621 .98 (.42)
ailway Engineer, August, p. 314.
A new **crank shaper machine** for railway workshops. 1 400 words & fig.)

1930 621 .132.8 (.43) & 621 .43 (.43)
ailway Engineer, August, p. 317.
Diesel compressed-air locomotive, German Railways. 3 500 words, 1 table & fig.)

1930 656 .255
ailway Engineer, August, p. 323.
Non-token operation of single lines. — I. (3 000 words fig.)

1930 625 .233
ailway Engineer, August, p. 326.
Electric train-lighting equipment. — X. (2 500 words fig.)

1930 625 .143.3
ailway Engineer, September, pp. 335 and 347.
Transverse fissures in steel rails. (2 600 words & g.)

1930 621 .138.5 (.42)
ailway Engineer, September, p. 337.
The Derby **Locomotive Works** of the London Midland Scottish Railway. — I. (4 000 words & fig.)

1930 621 .132.8 & 621 .43
Railway Engineer, September, p. 349 and October, p. 384.
GEIGER (F.). — **Diesel locomotive design.** — I. (5 000 words & fig.)

1930 621 .134.3
Railway Engineer, September, p. 355.
A new (Holmes) locomotive **poppet valve gear.** (2 300 words & fig.)

1930 656 .251
Railway Engineer, September, p. 357.
The disadvantages of **two-position block instruments.** (1 500 words & fig.)

1930 621 .135.4 & 625 .215
Railway Engineer, September, p. 359.
DENDY MARSHALL (C. F.). — **The motion of railway vehicles on a curved line.** — I. (3 100 words & fig.)

1930 625 .233
Railway Engineer, September, p. 363.
COPPOCK (C.). — **Electric train lighting equipment.** — XI. (2 600 words & fig.)

1930 621 .132.8 (.42)
Railway Engineer, October, p. 373.
New **Beyer-Garratt locomotives,** London Midland and Scottish Railway. (500 words & fig.)

1930 625 .175 (.42)
Railway Engineer, October, p. 374.
Mechanically **propelled trolleys for permanent-way maintenance.** (1 700 words & fig.)

1930 656 .255
Railway Engineer, October, p. 377.
Non token operation of single lines. — II (1 700 words & fig.)

1930 621 .134.3
Railway Engineer, October, p. 379.
Superheater drain cocks. (500 words & fig.)

1930 625 .113
Railway Engineer, October, p. 380.
HEARN (Sir Gordon). — **Linking permanent-way on curves.** (1 100 words & fig.)

1930 621 .132.8 (.47)
Railway Engineer, October, p. 381.
Diesel rail motors with change speed gearing. (1 800 words & fig.)

1930 621 .132.3 (.73)
Railway Engineer, October, p. 386.
POULTNEY (E. C.). — Some modern **American passenger locomotives.** — I. (1 800 words, 6 tables & fig.)

1930 **621 .135.4 & 625 .22**
Railway Engineer, October, p. 390.
DENDY MARSHALL (C. F.). — **The motion of railway vehicles on a curved line.** — II. (4 800 words & fig.)

1930 **625 .245 (.42)**
Railway Engineer, October, p. 395.
New 120-ton **trolley wagon,** Great Western Railway. (700 words & fig.)

1930 **625 .233 (.42)**
Railway Engineer, October, p. 397.
COPPOCK (C.). — **Electric train-lighting equipment.** — XII. (2 800 words & fig.)

Railway Gazette. (London.)

1930 **725 .31 (.54)**
Railway Gazette, 1 August, p. 148.
New Central Station of the East Indian Railway at Cawnpore. (750 words & fig.)

1930 **625 .245 (.42)**
Railway Gazette, 1 August, p. 151.
New 120-ton **trolley wagon,** Great Western Railway. (400 words & fig.)

1930 **656 .1 (.82)**
Railway Gazette, 1 August, p. 154.
Road transport in the North-East Argentine. (1 000 words & fig.)

1930 **656 .232 (.54)**
Railway Gazette, 8 August, p. 185.
WAGSTAFF (H. W.). — **The operating ratio as a measure of efficiency.** (1 900 words, table & fig.)

1930 **625 .245 (.42)**
Railway Gazette, 8 August, p. 190.
New 20-ton **flat trolley wagon,** London & North Eastern Railway. (150 words & fig.)

1930 **621 .132.8 (.82)**
Railway Gazette, 8 August, p. 191.
Beyer-Garratt locomotives for the Buenos Ayres Midland Railway. (400 words & fig.)

1930 **625 .232 (.42)**
Railway Gazette, 15 August, pp. 213 and 227.
New **first-class sleeping cars,** London & North Eastern Railway. (1 050 words & fig.)

1930 **625 .162 (.42)**
Railway Gazette, 15 August, p. 216.
Pole-type **level-crossing barriers** in England. (200 words & fig.)

1930 **621 .132.5 (.66)**
Railway Gazette, 15 August, p. 219.
New **4-8-2 locomotives,** Nigerian Railway. (400 words & fig.)

1930 **313 .385.5 (.4**
Railway Gazette, 22 August, p. 241.
Census of railway employees. (300 words & table.)

1930 **385. (064 (.4**
Railway Gazette, 22 August, p. 242.
Rolling-stock for the Liverpool & Manchester Railwa centenary exhibition. (500 words & fig.)

1930 **656 .254 (.4**
Railway Gazette, 22 August, p. 244.
Telegraph Department developments on the Lond Midland and Scottish Railway. (1 400 words & fig.)

1930 **621 .94 (.4**
Railway Gazette, 22 August, p. 246.
A new **railway wheel lathe.** (600 words & fig.)

1930 **625 .232 (.4**
Railway Gazette, 29 August, p. 269.
New composite **sleeping cars,** London Midland Scottish Railway. (800 words & fig.)

1930 **625 .245 (.4**
Railway Gazette, 29 August, p. 273.
Great Western Railway 120-ton **trolley wagon** in se vice. (500 words & fig.)

1930 **621 .134.3 (.4**
Railway Gazette, 29 August, p. 274.
Locomotive valve gear conversion on the Great Soutl ern Railways, Ireland. (400 words & fig.)

1930 **656 .1 (.4**
Railway Gazette, 29 August, p. 283.
British Railways and road transport undertaking (1 table.)

1930 **385. (064 (.42) & 385. (09 (.4**
Railway Gazette, 5 September, p. 305.
The Liverpool and Manchester **Railway centenar celebrations.** (2 700 words & fig.)

1930 **385. (09 (.4**
Railway Gazette, 5 September, p. 307.
DENDY MARSHALL (C. F.). — The **Liverpool an Manchester Railway.** (2 100 words & fig.)

1930 **621 .132.8 (.4**
Railway Gazette, 5 September, p. 313.
New **Beyer-Garratt locomotives,** London Midland Scottish Railway. (800 words & fig.)

1930 **385. (064 (.4**
Railway Gazette, 5 September, p. 316.
Locomotives and rolling stock for the Liverpool an Manchester Railway **centenary proceedings.** (800 word & fig.)

1930 **621 .331 (.8**
Railway Gazette, 12 September, p. 336.
Supervisory control of **sub-stations** on the Centra Argentine Railway. (13 000 words & fig.)

1930 621 .132.3 (.54)
Railway Gazette, 12 September, p. 339.
New **4-6-2 type locomotives** for Indian railways. (300 words & figure.)

1930 621 .94
Railway Gazette, 12 September, p. 342.
A new high-speed **lathe.** (500 words & fig.)

1930 621 .132.4 (.54)
Railway Gazette, 12 September, p. 345.
4-6-0 locomotive for India exhibited at the Liverpool & Manchester Railway Centenary. (200 words & fig.)

1930 621 .134.3 (.42)
Railway Gazette, 19 September, p. 364.
Holmes **poppet valve gear** for locomotives. (500 words & fig.)

1930 385. (064 (.42)
Railway Gazette, 19 September, p. 366.
Liverpool & Manchester Railway **centenary celebration.** (3 900 words.)

1930 625 .212
Railway Gazette, 19 September, p. 373.
The Lang laminated **wooden wheel centre.** (1 000 words & fig.)

1930 625 .245 (.42)
Railway Gazette, 19 September, p. 377.
Great Western Railway 120-ton **well-type crocodile wagon.** (350 words & fig.)

1930 625 .235 (.73)
Railway Gazette, 19 September, p. 378.
The Leeds-Tozzer **car-washing machine.** (200 words & fig.)

1930 621 .132.6 (.42)
Railway Gazette, 26 September, p. 397.
New 2-6-2 type **tank engine,** London & North Eastern Railway. (800 words & fig.)

1930 625 .143.5 (.42)
Railway Gazette, 26 September, p. 399.
An improved **rail anti-creep device.** (800 words & fig.)

1930 621 .95 (.42)
Railway Gazette, 26 September, p. 401.
A new **machine tool (boring mill)** for railway work. (500 words & fig.)

1930 621 .35 (.42)
Railway Gazette, 26 September, p. 401.
The **accumulator** section at Wolverton works, London Midland & Scottish Railway. (300 words & fig.)

1930 656 .262 (.71)
Railway Gazette, 26 September, p. 404.
A mobile **railway town.** (300 words & fig.)

1930 347 .763 (.42)
Railway Gazette, 26 September, p. 406.
The new **road traffic act.** (1 400 words.)

1930 656 .1 (.45)
Railway Gazette, 26 September, p. 408.
Motor roads and **motor transport in Italy.** (1 800 words & fig.)

Railway Engineering and Maintenance. (Chicago.)

1930 625 .144.4 (.73)
Railway Engineering and Maintenance, August, p. 328.
ROBINSON (C. W.). — Pennsylvania organizes **division extra gangs.** (1 800 words & fig.)

1930 625 .143.1 (09 (.73)
Railway Engineering and Maintenance, August, p. 331.
Ninety-five years of rail on the Boston & Maine. (600 words & fig.)

1930 625 .123 (.73)
Railway Engineering and Maintenance, August, p. 332.
Corrugated metal **culverts.** (2 400 words & fig.)

1930 621 .133.7 (.73) & 725 .33 (.73)
Railway Engineering and Maintenance, August, p. 336.
Rock Island turns to gravel-wall **wells.** (1 600 words & fig.)

1930 625 .175
Railway Engineering and Maintenance, August, p. 339.
KNOWLES (C. R.). — The care of **motor cars.** (2 300 words & fig.)

1930 625 .143.3
Railway Engineering and Maintenance, August, p. 343.
BALDRIDGE (C. W.). — What are the causes of **rail batter?** (1 800 words & fig.)

1930 625 .122 (.73)
Railway Engineering and Maintenance, Sept., p. 368.
Little **streams** cause big problems on the Erie. (2 200 words & fig.)

1930 621 .133.7 (.73) & 725 .33 (.73)
Railway Engineering and Maintenance, Sept., p. 372.
JOHNSON (A. W.). — **Reservoir replaces well** at Galesburg. (1 200 words & fig.)

1930 625 .175
Railway Engineering and Maintenance, Sept., p. 376.
KNOWLES (C. R.). — How to secure efficient operation from a **motor car.** (2 300 words & fig.)

1930 625 .173 (.73)
Railway Engineering and Maintenance, Sept., p. 380.
Putting **rail gangs** on a production basis. (5 400 words, table & fig.)

Railway Magazine. (London.)

1930 **385. (09 (.42)**
The Railway Magazine, No. 400, October, p. 260.
SEKON (G. A.). — **Railway progress and development,** 1922-1930. (2 200 words & fig.)

1930 **656 .222.1 (.42)**
The Railway Magazine, No. 400, October, p. 268.
ALLEN (Cecil J.). — **British locomotive performance** in 1897 and 1930. (3 000 words, tables & fig.)

1930 **621 .13 (09 (.42)**
The Railway Magazine, No. 400, October, p. 281.
LAKE (Chas. S.). — **Locomotive development,** 1897-1930. (2 400 words & fig.)

1930 **656 .222.1 (.42)**
The Railway Magazine, No. 400, October, p. 290.
British passenger train services, 1897-1930. (3 000 words & fig.)

1930 **621 .33 (.42)**
The Railway Magazine, No. 400, October, p. 300.
FRANCIS (J.). — **Electric traction in the British Isles.** (1 400 words & fig.)

1930 **656 .1 (.42) & 656 .261 (.42)**
The Railway Magazine, No. 400, October, p. 305.
The railways and road transport. (600 words & fig.)

1930 **656 .25 (.42)**
The Railway Magazine, No. 400, October, p. 309.
The new **signalling** era. (1 300 words & fig.)

1930 **656 .29 (.42)**
The Railway Magazine, No. 400, October, p. 314.
A 1922-1930 **railway miscellany.** (1 600 words & fig.)

Railway Mechanical Engineer. (New York.)

1930 **625 .244 (.73)**
Railway Mechanical Engineer, August, p. 435.
All-steel iceless **refrigerator car** equipped with improved thermostat control and heating system. (2 500 words & fig.)

1930 **625 .211 (.73) & 625 .216 (.73)**
Railway Mechanical Engineer, August, p. 441.
Duryea **cushion underframe** on nearly 10 000 cars. (3 600 words & fig.)

1930 **621 .132.1 (.73)**
Railway Mechanical Engineer, August, p. 446.
Locomotives recently delivered. (1 table & fig.)

1930 **621 .135.1**
Railway Mechanical Engineer, August, p. 448.
Cross-balancing the main driving wheel. (A. R. A. report illustrates calculations of weight and position of balance for out-of-plane action of revolving weight). (5 000 words & fig.)

1930 **625 .26 (.7**
Railway Mechanical Engineer, August, p. 454.
PALMER LERCH (G.). — **Gas-electric rail car mai**
tenance on the Reading. (2 400 words & fig.)

1930 **621 .132.3 (.4**
Railway Mechanical Engineer, September, p. 491.
High pressure locomotive being tested in German
Pacific type built for the German State Railways
the Loeffler principle. Boiler pressure of 1 700 lb. (2 4
words & fig.)

1930 **625 .246 (.7**
Railway Mechanical Engineer, September, p. 497.
Service record of 100-ton **(pressed steel) car wi**
four-wheel trucks. (1 300 words & fig.)

1930 **621 .133.4 & 621 .133**
Railway Mechanical Engineer, September, p. 499.
ARMSTRONG (Geo W.). — Improving **draft eff**
ciency. The annular-ported exhaust nozzle with a sui
ably proportioned stack reduces back pressure. (3 2
words, 1 table & fig.)

1930 **625 .2 (06 (08 (.7**
Railway Mechanical Engineer, September, p. 503.
Car men addressed by T. C. Powell. (**Master Car Bu**
ders' and Supervisors' Association Convention, 26-28 A
gust). (4 100 words, tables & fig.)

1930 **625 .234 (.7**
Railway Mechanical Engineer, September, p. 508.
Greater comfort for the railroad passenger. Baltimo
and Ohio equips **dining car** with Carrier system of a
conditioning. (2 100 words & fig.)

1930 **625 .214 (.7**
Railway Mechanical Engineer, September, p. 511.
Baggage-mail cars equipped with **roller bearings.** (6
words & fig.)

Railway Signaling. (Chicago.)

1930 **656 .257 (.7**
Railway Signaling, No. 8, August, p. 275.
CRONK (C. D.). — **Interlocking** at the Clevela
Union terminal. (5 400 words & fig.)

1930 **625 .162 (.73) & 656 .254 (.7**
Railway Signaling, No. 8, August, p. 285.
Highway crossing signals on lines in St. Louis, M
(800 words & fig.)

1930 **656 .257 (.7**
Railway Signaling, No. 8, August, p. 287.
CHARLTON (R. C.). — Two **automatic interlockin**
installed on the Oregon-Washington Railroad & Na
gation Co. (Union Pacific System). (1 400 words & fig

1930 **656 .257 (.7**
Railway Signaling, No. 8, August, p. 290.
Automatic interlocking installed by New York Centr
at crossing with Monon at San Pierre, Ind. (2 700 wor
& fig.)

1930 691
ailway Signaling, No. 8, August, p. 293.
LUXFORD (R. F.). — Moisture content in the design
wood pole lines. (1 100 words & fig.)

1930 656 .256.3 (.73)
ailway Signaling, No. 9, September, p. 311.
1930 program of Missouri Pacific includes 400 miles
automatic signaling. (2 900 words & fig.)

1930 656 .256.3 (.73)
ailway Signaling, No. 9, September, p. 315.
Frisco extends automatic signaling on 130 miles.
2 200 words & fig.)

1930 656 .255 (.73)
ailway Signaling, No. 9, September, p. 318.
ZANE (W. F.). — Burlington completes centralized
affic control on 24 miles of single track. (3 100 words,
tables & fig.)

1930 656 .258
ailway Signaling, No. 9, September, p. 323.
STOLTZ (C. F.). — Big Four installs simplified
terlocking with no mechanical locking. (2 100 words
fig.)

1930 656 .254 (.73)
ailway Signaling, No. 9, September, p. 327.
Remotely controlled signals replace manual block
ation on New York Central. (1 500 words & fig.)

1930 625 .258 (.42) & 656 .254 (.42)
ailway Signaling, No. 9, September, p. 329.
Froehlich hydraulic car retarder system at Whitemoor
ard, London & North Eastern Ry (England). (5 200
ords & fig.)

outh African Railways & Harbours Magazine. (Johannesburg.)

1930 625 .142.3 (.68)
outh African Rys. and Harbours Mag., Aug., p. 1195.
The advance of steel sleepers in South Africa. (1 300
ords.)

1930 621 .132.1 (.68)
outh African Rys. and Harbours Mag., Sept., pp. 1312,
1313, 1342, 1343, 1350.
Types of engines in use on the South African Rail-
ays. (Tables & fig.)

In Spanish.

Gaceta de los Caminos de hierro. (Madrid.)

1930 656 .25
ac. de los Cam. de hierro, n° 3630, 20 de ag., p. 277;
n° 3631, 1 de sept., p. 289.
Mando automático de los trenes. (4 500 palabras.)

1930 651
Gac. de los Cam. de hierro, n° 3633, 20 de Sept., p. 313.
Maquinas de imprimir para la expendición de billetes.
(1 100 palabras.)

Ingenieria y Construcción. (Madrid.)

1930 625 .1 (.460)
Ingenieria y Construcción, septiembre, p. 473.
MURUA (J.). — El ferrocarril de Zamora a La Coruña. (3 300 palabras, cuadros & fig.)

1930 621 .132.8 (.81)
Ingenieria y Construcción, septiembre, p. 493.
SCHAMBERGER (O.). — Coches automotores con motor de gasolina para el Ferrocarril Central Brasileño. (1 800 palabras & fig.)

Revista de Obras Publicas. (Madrid.)

1930 625 .14
Revista de Obras Publicas, n° 17, 1° de sept., p. 402.
Unificación del material fijo de vía. (800 palabras & fig.)

1930 624 .2 (01
Revista de Obras Publicas, n° 18, 15 de sept., p. 424.
MENDIZABAL (D.). — Nuevos estudios sobre el « Impacto ». (2 300 palabras & fig.)

1930 656 .213 (.460)
Revista de Obras Publicas, n° 18, 15 de sept., p. 431.
DE UCELAY (J.). — Los ferrocarriles del Norte de España y el problema del « Hinterland de Bilbao ». (1 800 palabras & fig.)

In Italian.

Annali dei lavori pubblici. (Roma.)

1930 . 624 .2
Annali dei lavori pubblici, giugno, p. 477.
GUIDI (C.). — Trair continue da ponte solidali con piedritti incastrati alla base. (500 parole, tavole & fig.)

L'Ingegnere. (Roma.)

1930 656 .213 (.45)
L'Ingegnere, luglio, p. 434.
STRADELLI (A.). — La stazione frigorifera specializzata per frutta e verdure in Verona. (4 200 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1930 656 (.73)
Rivista tecnica delle ferrovie ital., 15 luglio, p. 1.
LANINO (P.). — L'esercizio ferroviario degli Stati Uniti. (6 300 parole.)

1930 621 .335 (.45)
Rivista tecnica delle ferrovie ital., 15 luglio, p. 13.
BIANCHI (G.). — **I locomotori** a corrente continua a 3 000 volt gruppi E 625 ed E 626. (7 800 parole & fig.)

1930 385. (06 (.460)
Rivista tecnica delle ferrovie ital., 15 agosto, p. 65.
TOSTI (L.). — Lo stato attuale di alcuni più importanti **problemi ferroviari esaminato al Congresso internazionale di Madrid.** (8 000 parole.)

1930 656 .211.5 (.45)
Rivista tecnica delle ferrovie ital., 15 agosto, p. 81.
FERRARESE (L.). — **Sottopassagio viaggiatori** nella Stazione di Padova Centrale. (3 000 parole & fig.)

In Dutch.

De Ingenieur. (Den Haag.)

1930 669 .1 & 691
De Ingenieur, N^r 33, 15 Augustus, bl. B. 190.
VAN GENDEREN STORT (E. A.). — Het **weerstandsvermogen van beton en staal** tegen vuur. (5 000 woorden & fig.)

1930 625 .62
De Ingenieur, N^r 39, 26 September, bl. V. 41.
BRUNNER (H. J. R.). — **Twee- en vierassige motorrijtuigen** met onderscheidenlijk twee en vier motoren in electrische trambedrijven. (600 woorden & 4 tafereelen.)

1930 621 .43
De Ingenieur, N^r 39, 26 September, bl. V. 43.
Eenige bijzonderheden over de **Dieseltramwagens** van de Great Southern Railway in Buenos Ayres. (1 200 woorden & fig.)

Spoor- en Tramwegen. (Utrecht.)

1930 621 .135.4
Spoor- en Tramwegen, N^r 5, 2 September, p. 127; N^r 6, 16 September, p. 152.
HARDEMAN (W. F. K.). — **Locomotief-constructies** voor het doorloopen van Railbanen met kleine boogstralen. (2 000 woorden & fig.)

1930 385. (09.3
Spoor- en Tramwegen, N^r 6, 16 September, p. 163.
ASSELBERGHS (H.). — Een **honderd-jarige** en hoe de eerste stappen op het ijzeren pad gezet werden. (1 500 woorden & fig.)

In Polish.

INŻYNIER KOLEJOWY. (Warszawa).

1930 385 .52 (.438)
Inzynier Kolejowy, 1 Wrzesnia, p. 355.
BLASZKOWSKI (H.). — O naszym systemie « placy dziennej ». (2 800 slowa.)

1930 625 .13 (.438)
Inzynier Kolejowy, 1 Wrzesnia, p. 360.
SZELAGOWSKI (F.). — Wzmocnienie mostu drogowo-kolejowego przez rzeke Wisle w Toruniu. (3 500 slowa & rys.)

1930 625 .253
Inzynier Kolejowy, 1 Wrzesnia, p. 368.
RIHOSEK (J.). — Hamulce jednokomorowe o powietrzu sprezonem y zaworem roznicowym. (2 000 slowa & rys.)

In Portuguese.

Boletim do Instituto de Engenharia. (S. Paulo.) (Brasil.)

1930 656 .28 (.81)
Boletim do Instituto de Engenheria, Julho, p. 1.
PINTO DA COSTA (J. B.). — **Relatorio** sobre o accidente do RP-1 occorido em 18 de Setembro de 1929 no Ramal de S. Paulo, no Km. 188. (3 400 palavras & fig.) (continúa).

Revista das Estradas de Ferro. (Rio de Janeiro.)

1930 621 .132.8 (.81)
Revista das Estr. de Ferro, n° 120, 15 de Julho, p. 348.
As **novas machinas** « Beyer Garratt » da Leopoldina Railway. (400 palavras, 1 cuadro & fig.)

1930 656 .25
Revista das Estr. de Ferro, n° 121, 30 de Julho, p. 365.
Os novos systemas de **signalisaçâo.** (900 palavras & fig.)

1930 385 (.8)
Revista das Estr. de Ferro, n° 122, 15 de Ag., p. 395.
Estradas de ferro da America do Sul. (3 500 palavras, cuadros & fig.)

1930 621 .134.3 (.43)
Revista das Estr. de Ferro, n° 123, 30 de Ag., p. 423.
Locomotiva de caldeira de alta pressâo Löffler dos Estabelecimentos Schwartzkopff. (1 200 palavras & fig.)

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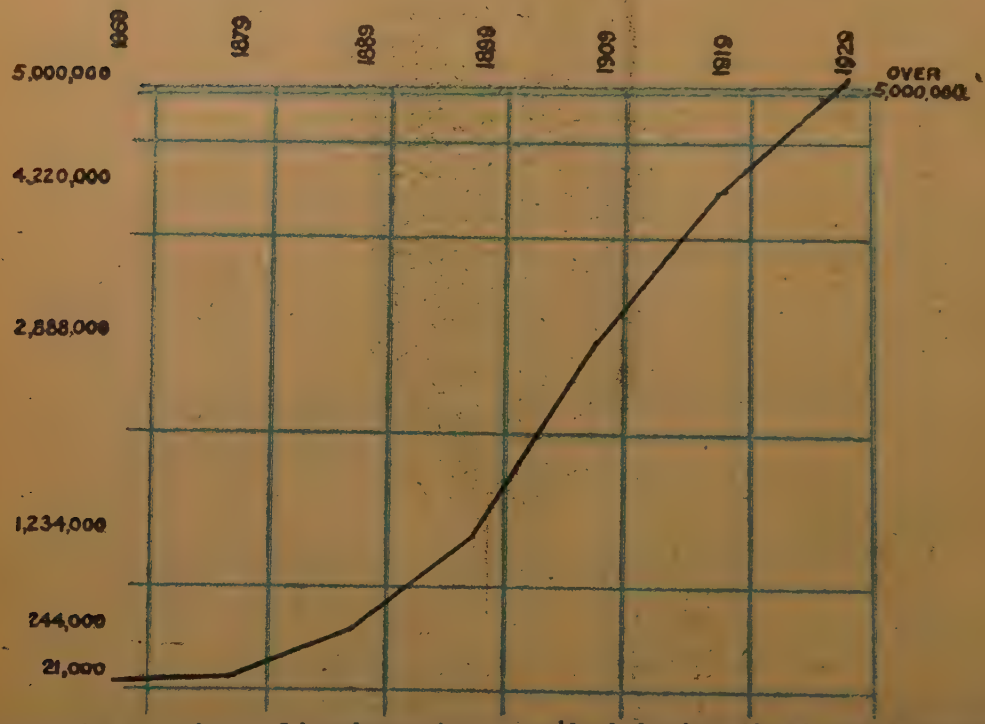

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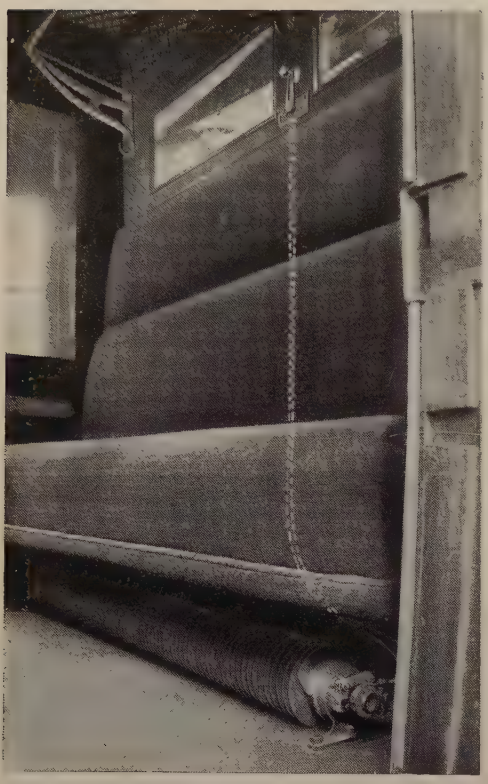

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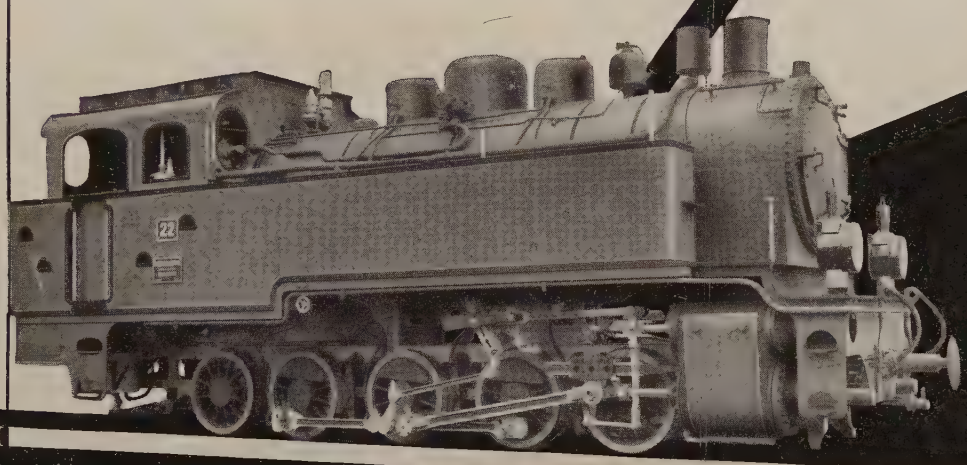

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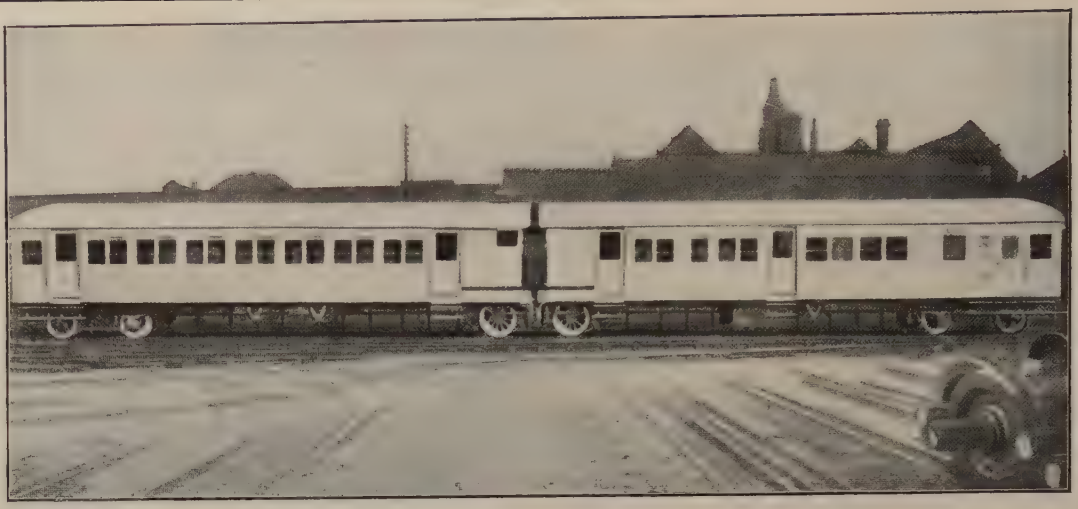

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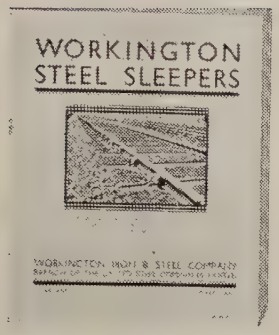

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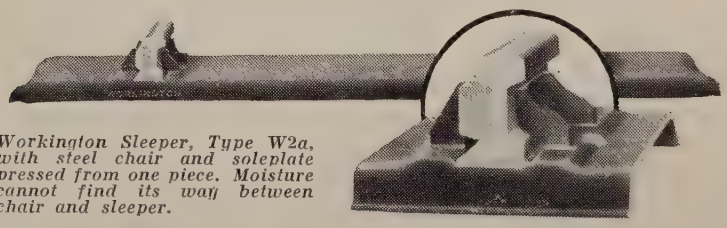

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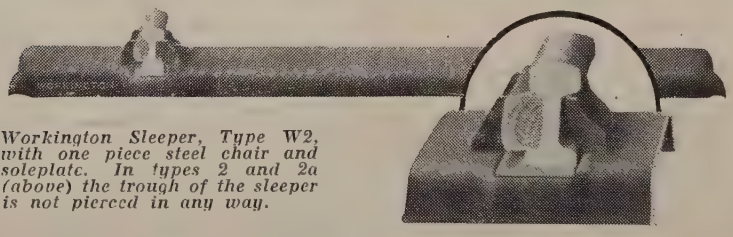
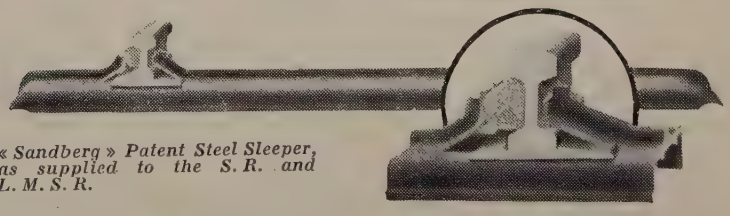
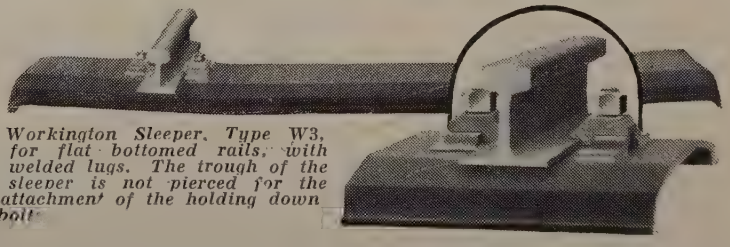


Workington Sleeper, Type W2, with one piece steel chair and soleplate. In types 2 and 2a (above) the trough of the sleeper is not pierced in any way.



« Sandberg » Patent Steel Sleeper, as supplied to the S. R. and L. M. S. R.



Workington Sleeper, Type W3, for flat bottomed rails, with welded lugs. The trough of the sleeper is not pierced for the attachment of the holding down bolt.

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WORKINGTON IRON & STEEL COMPANY

Branch of The United Steel Companies Limited

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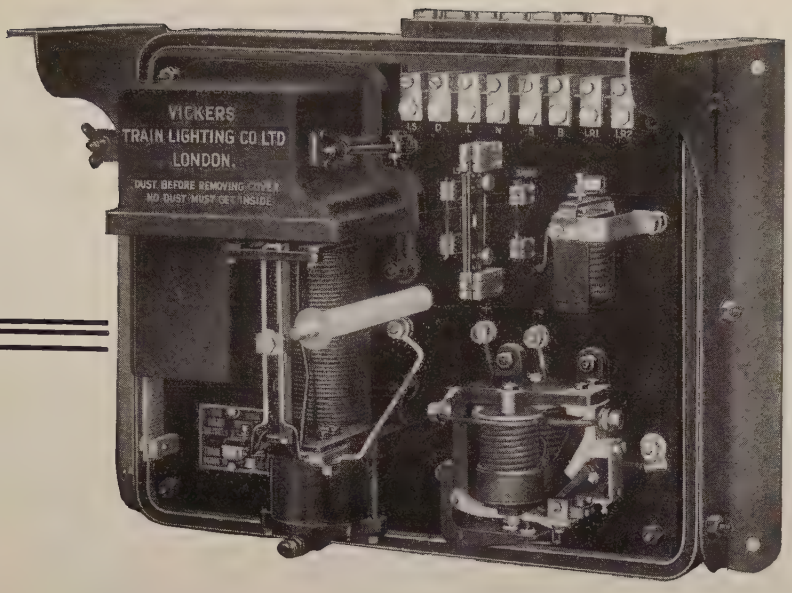

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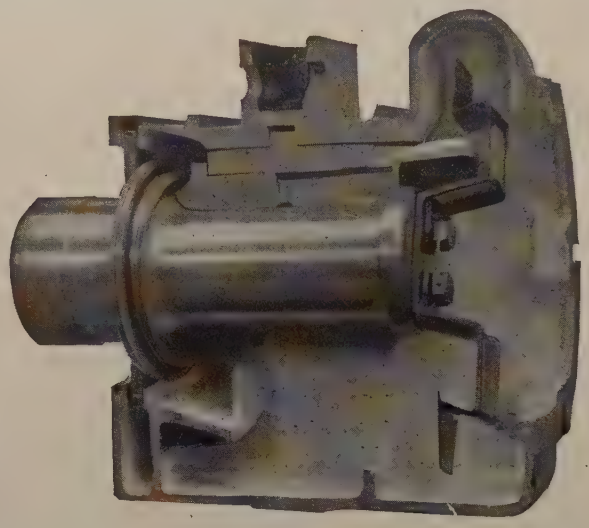

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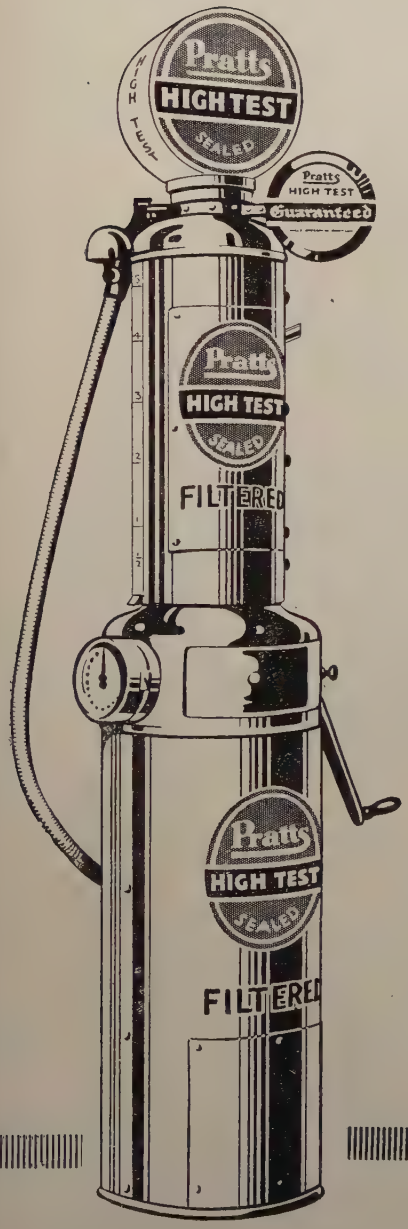

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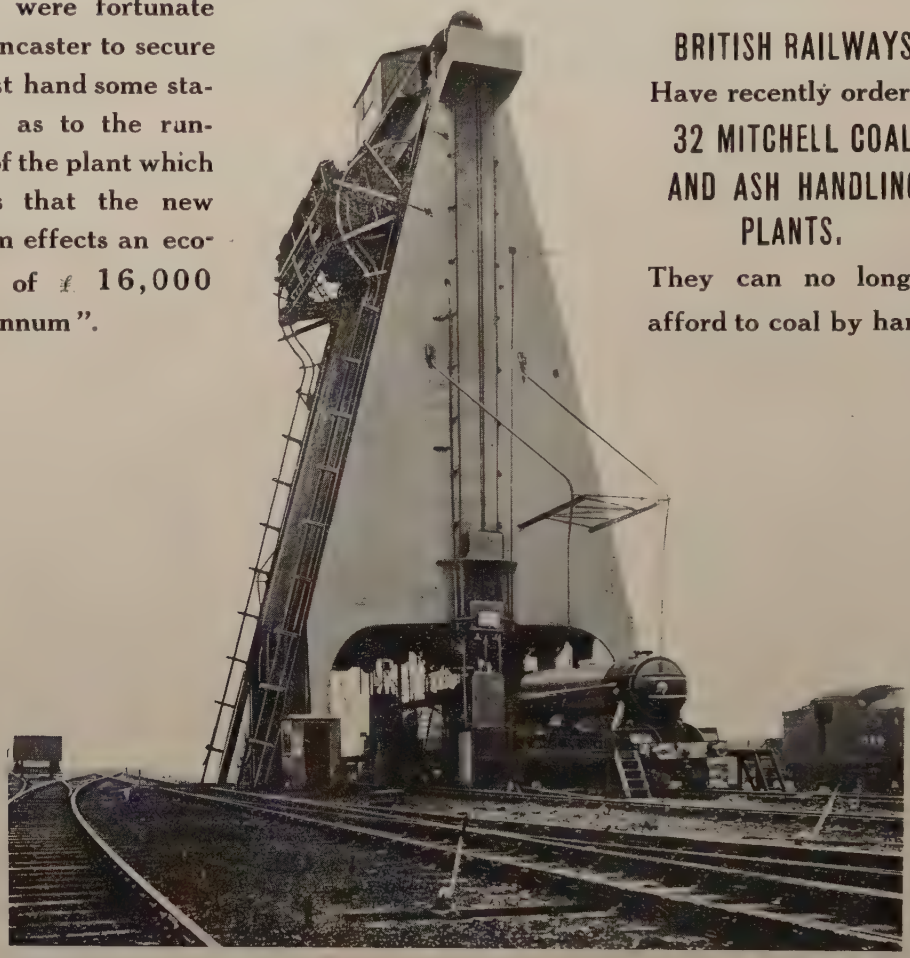

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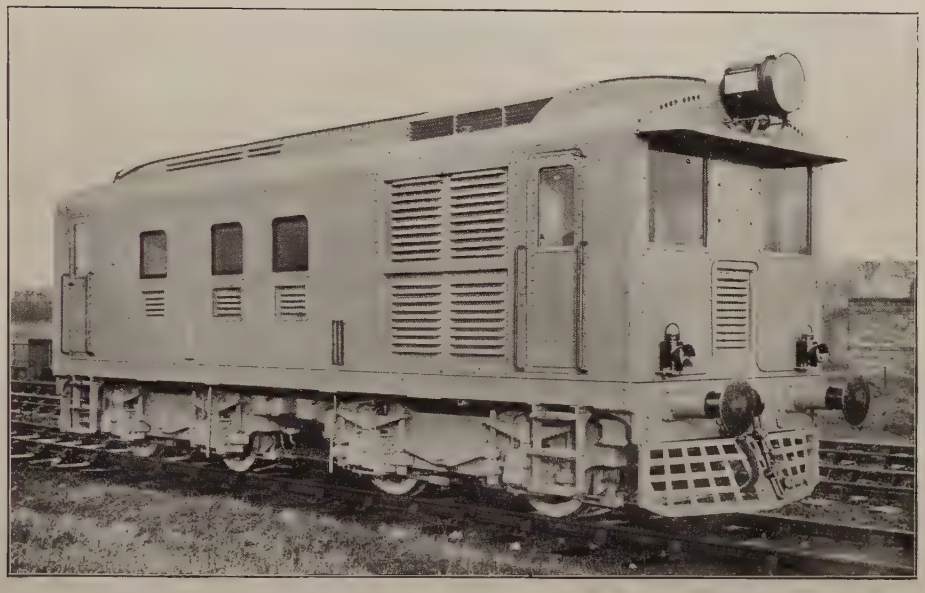

One of the 360 B.H.P. Diesel-Electric locomotives for the Indian State Railways (N.W.1.)

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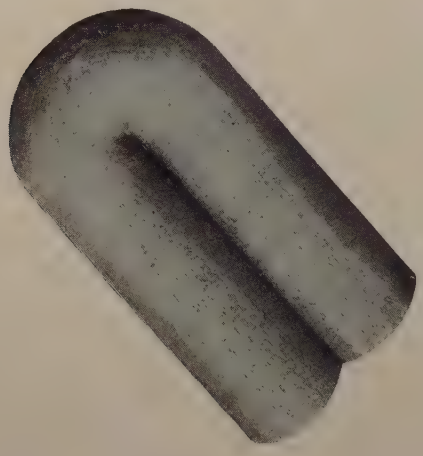
Elongation. . . . . 41.25 % on 4".

Yield . . . . . 5.56 tons per sq. inch.

Illustration shows tube Flange Tested (cold).



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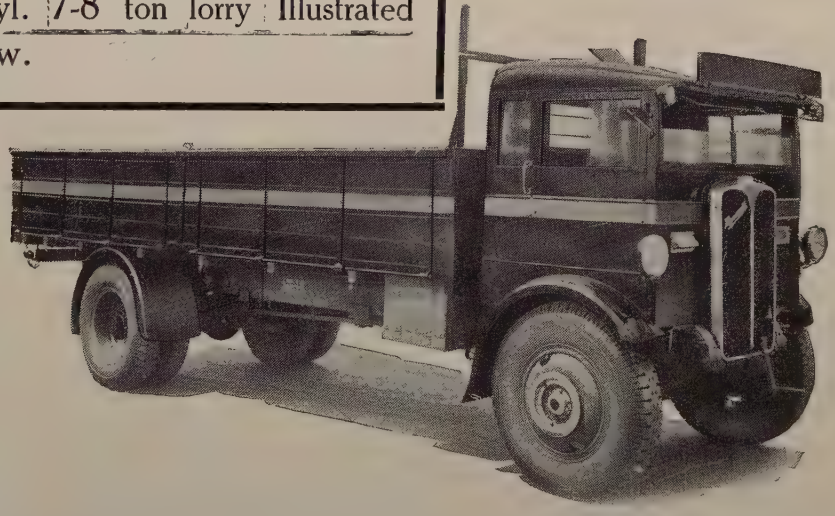

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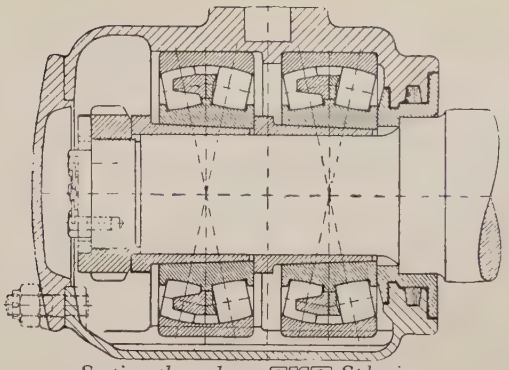

Section through an SKF Spherica Roller Beating Axle Box of the double bearing type.

THAT such famous systems as the State Railways of AUSTRIA, DENMARK, GERMANY, ITALY, NORWAY, SWEDEN, &c., and the principal railroads of the U.S.A. have adopted SKF Spherical Roller Bearing Axle Boxes for their rolling stock, is sufficient indication of their value and efficiency. It is significant, too, that these Axle Boxes were chosen for the famous Blue Train.

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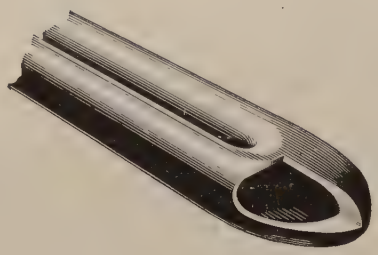

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Long experience has conclusively demonstrated the superiority of Elesco (Schmidt) superheaters from the standpoint of design and construction, as well as for reliability and efficiency in operation. This is due very largely to the fact that return bends, forged integrally with the tubing, are used exclusively to form the loops of the superheater elements or units. These bends are machine-forged without the use of either additional material or a flux.

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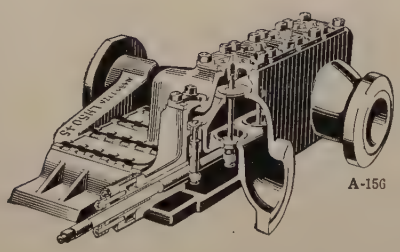

A-156

Collectors for Elesco superheaters are made of the very best gray iron and are designed to meet internal stresses to which they are subjected through variations in temperature and constant vibration.

In the illustration is shown a recent development of the finger type having the multiple-valve throttle or regulator integral with the casting. Without complicating the smokebox arrangement, it provides for steam at full boiler pressure always circulating through the units, which protects them against overheating, and control of the steam supply between the superheater and the cylinders. The steam supply to the cylinders is finely graduated by consecutive opening and closing of the series of small multiple valves. This type of collector is rapidly being adopted for every class of locomotive service.

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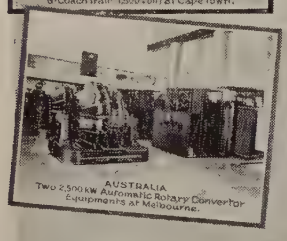
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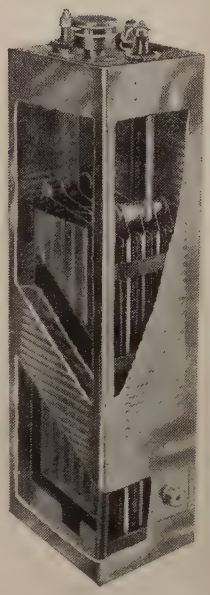

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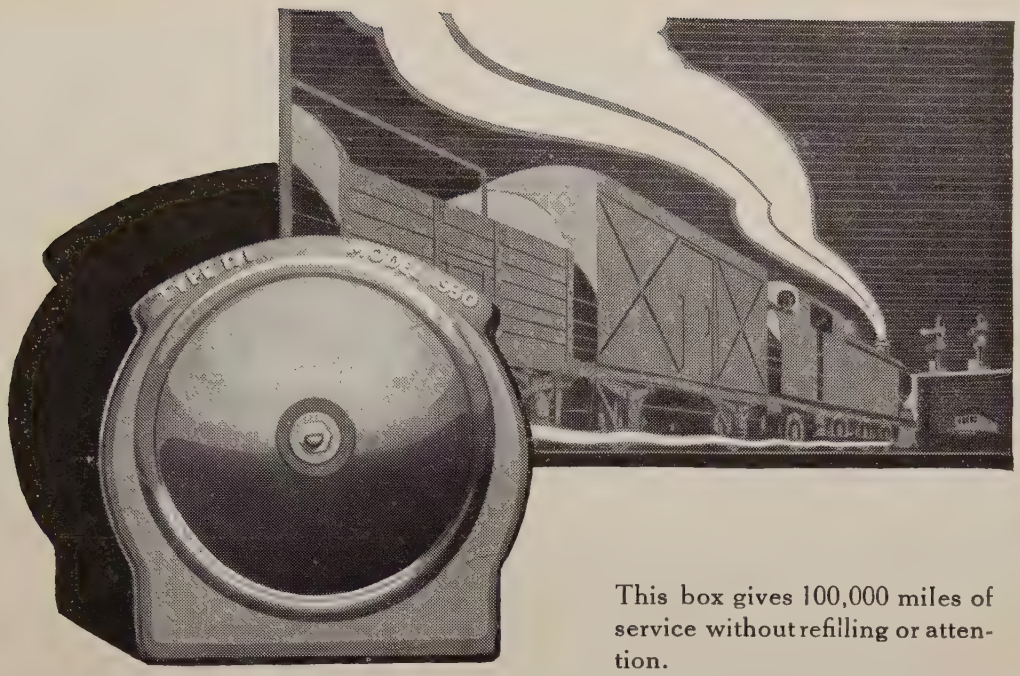

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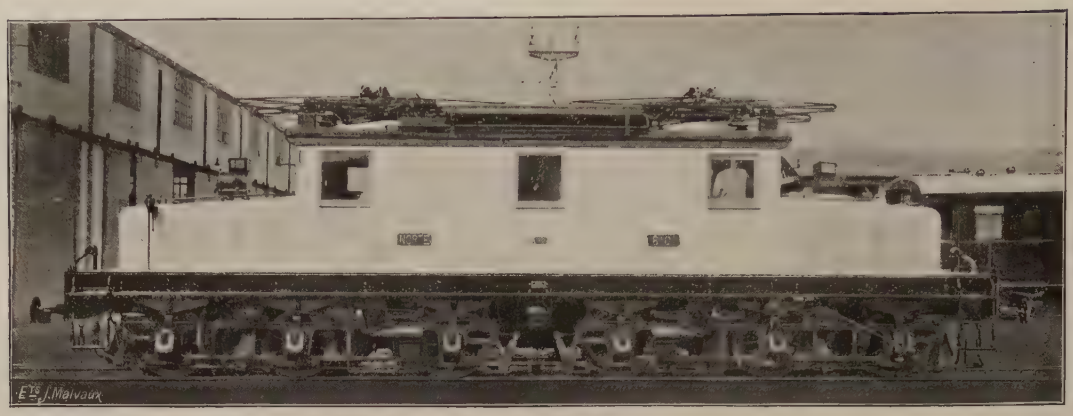

Electric locomotive for the Norther Spanish Ry. Co,
built by the Sociedad Española de Construccion Naval at their Bilbao Works.

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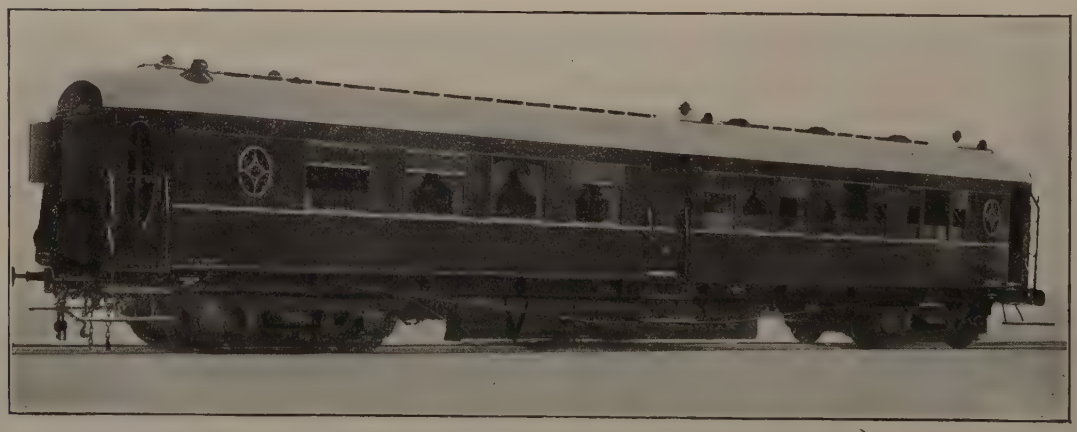

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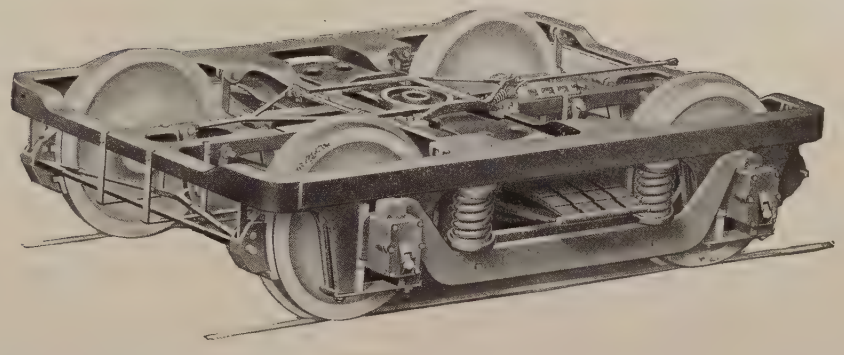

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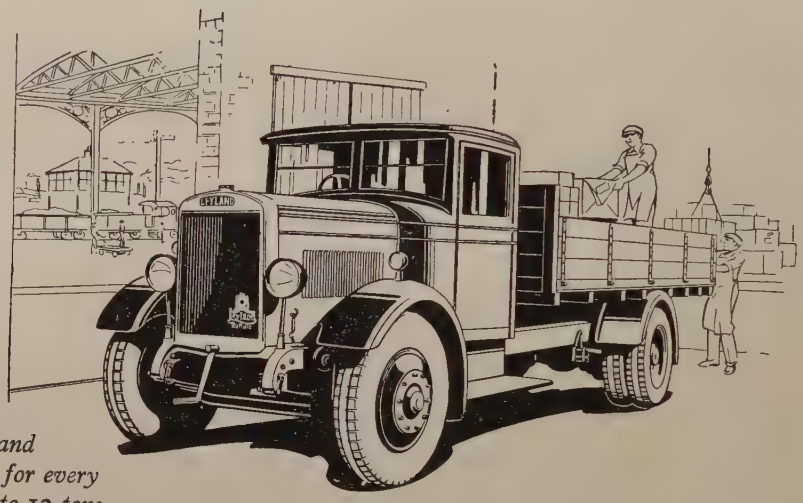

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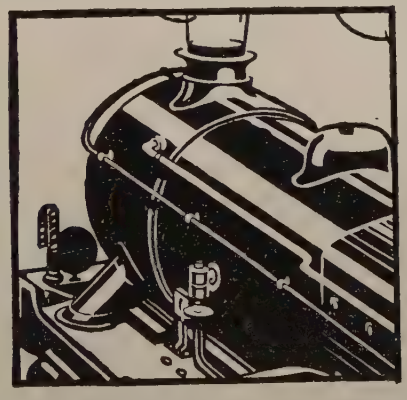

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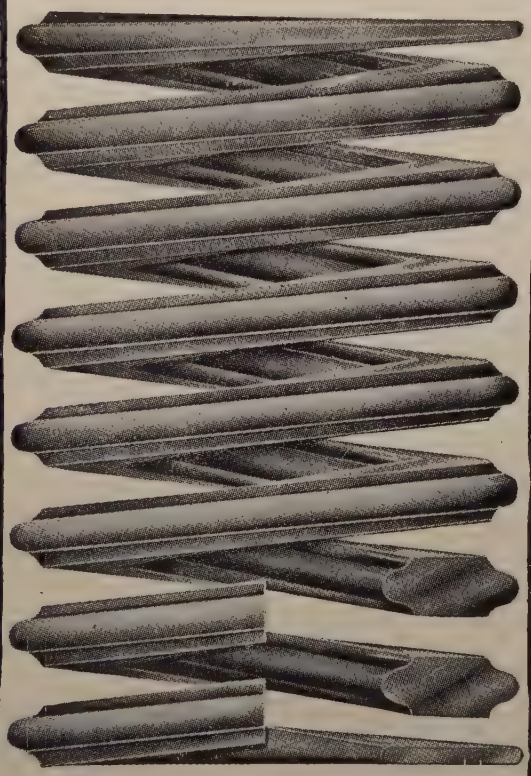

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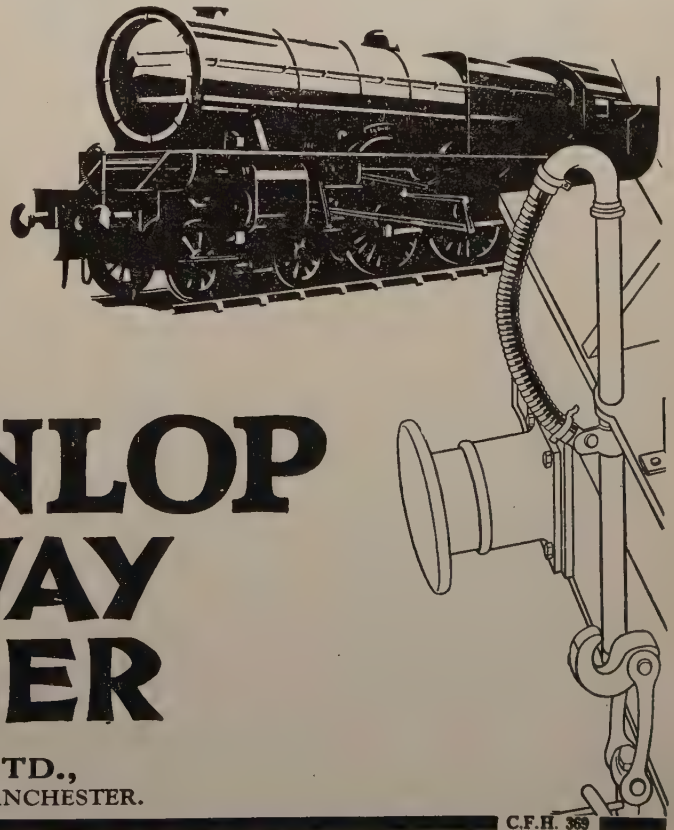

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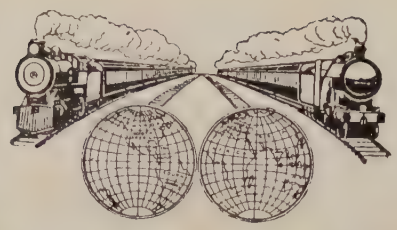

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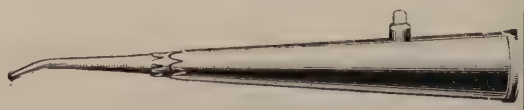

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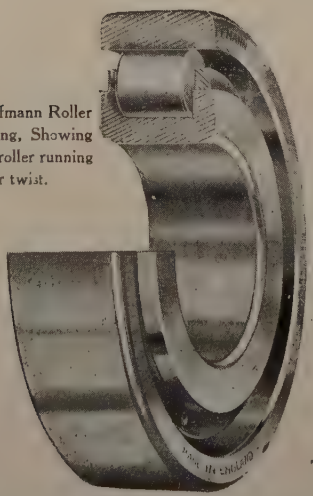

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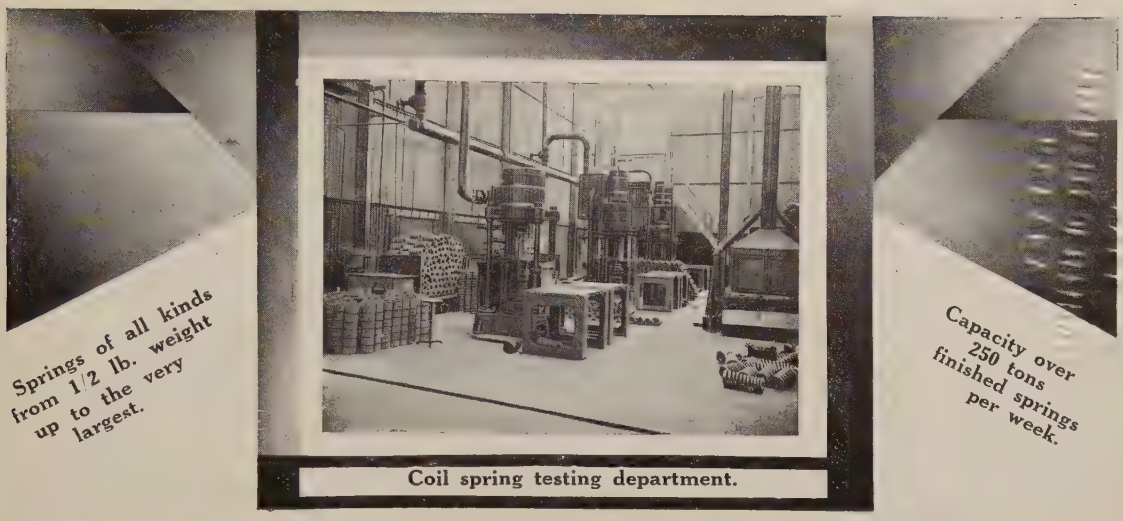

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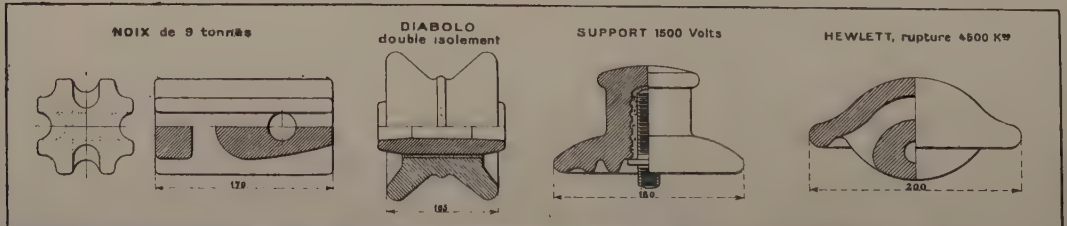

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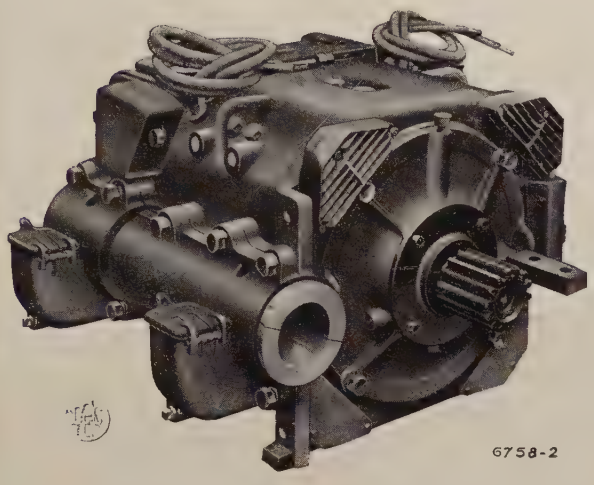

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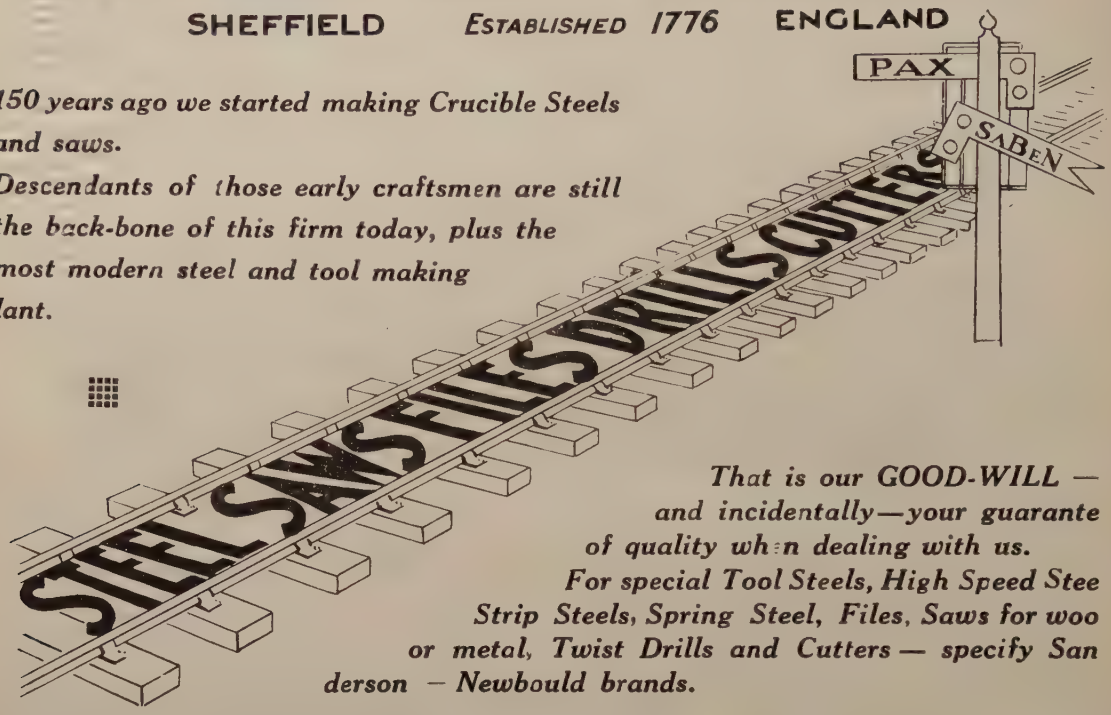

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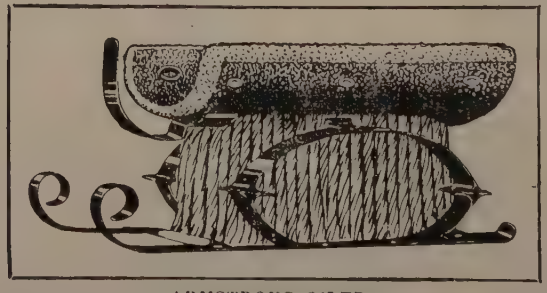

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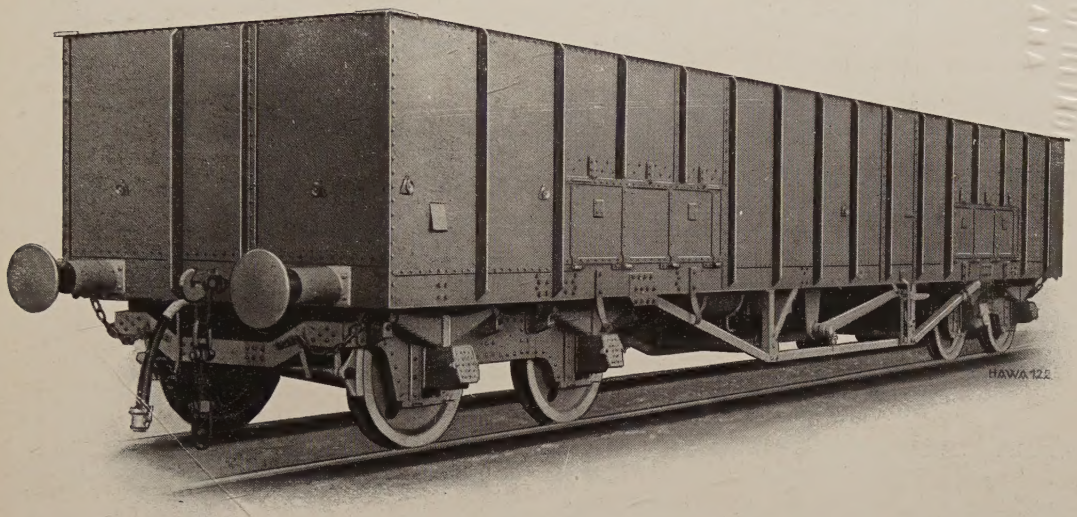

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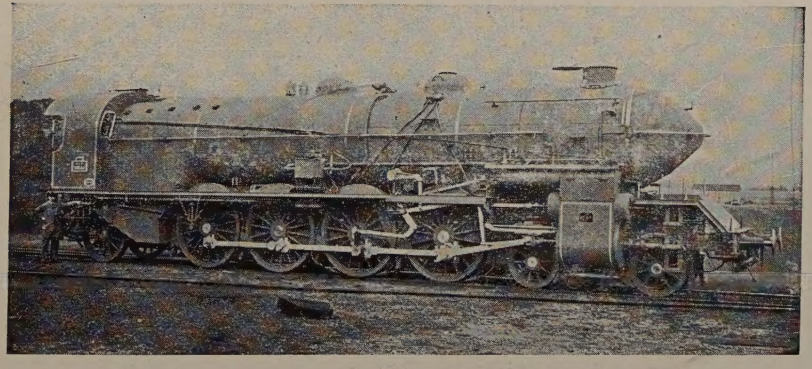

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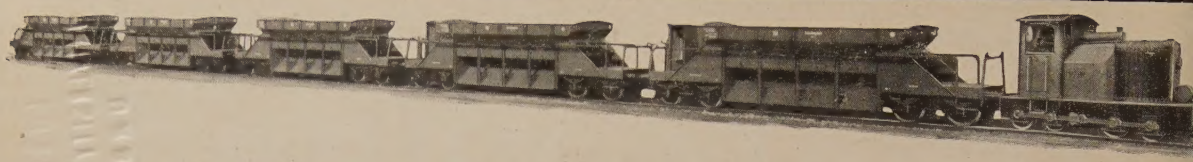

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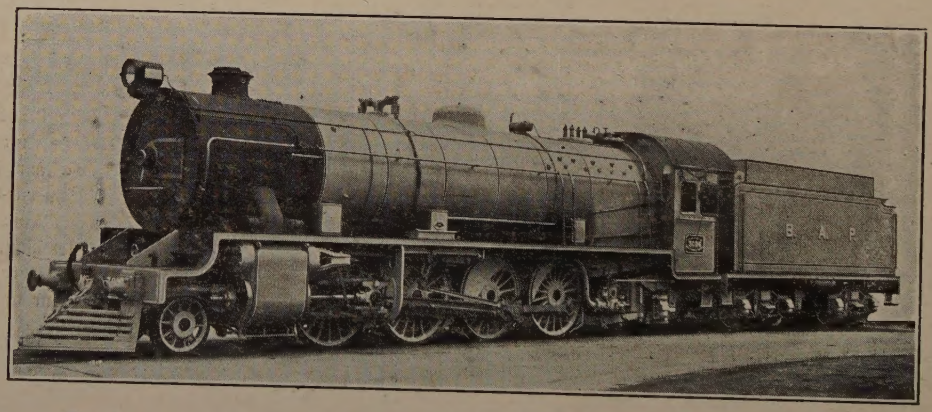

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